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73 magazine
for radio amateurs

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Phone: 603-924-3873. It's too damned late to sign up for the 73 tour in September and include Moscow, what with the incredibly slow system they have going, but it is possible to go along and hit all other stops if you send in your $200 deposit immediately. Send for poop sheets on the tour from Lin Green, 73, Peterborough NH 03458. Don't miss the trip of a lifetime. While it looks as if the Bajo Nuevo trip is filled, there may be room for some standbys . . . see page 112 last month. Positions are open in the advertising and editorial departments for experienced amateurs, OM or YL . . . they don't pay a lot but they are fun . . . and what is more important? 73 is growing rapidly. Now stop reading this trivia and get to the articles . . . and most important, send in that readers service list. The agonies of deep personal torment will plague you if you don't send it in.

EDITORIAL BY WAYNE GREEN

Caveat Emptor

That means buyer beware. Rather than go through long lists of problems that fellows have had with various firms, getting into a hassle over nits, perhaps a short list of who to contact for details about what firm is in order.

If you would like consumer info re: HT Specialists, also possibly known as Curtis Communications, in Willowdale, Ontario, write to Bob Coburn W1JJO, RFD 2 Tinkham Lane, Londonderry, NH 03053.

Consumer info on Herbert Gordon Company, also known as Bolton Labs, and possibly other names, Harvard, Mass., check with Charles Terry W4FZX 1300 Shady Lane, Orlando FL 32804; James Sandberg K6HE, 1138 E. Rustic Road, Escondido CA 92025; William Watts WAØSQL, 1020 Main, Durango CO 81301; Stanley Allan, R1 Box 99, Durango CO 81301; James Thurber W4ICF Box 373, Boynton Beach FL; Thea Vance, 212 Ellendale, Crown Point IN 46307; Max Fraser VE4MF, Binscarth, Manitoba; Carl Pohlner K3PZE, 1780 Joan, Balto MD 21234; Harvey Wills K6KYC, Box 462, Independence CA 93526.

There is quite a bunch of ham gear made up in Japan that is simply awful. This should not be confused with the fine gear that is being imported by reputable companies such as Standard, Drake, etc., which meet all U.S. specifications. Some of the rigs couldn't meet specs without a major rebuilding job. For instance the Standard 145, available only from Japan, and equal only in looks to the U.S. imported Standard 146, failed miserably in the *73* labs and seems like a real loser. Please watch out for anyone importing or even selling these – and watch out for anything else they are selling for if they will try and foist a 145 on you they may have no scruples about selling other useless gear.

FCC At It Again

Several of the operators using the WA6ZDI repeater in Los Angeles have received citations for signing their calls as "mobile" instead of "mobile six." Yes, this really happened. It seems so outrageous that it must be a put on, but I've seen the citations myself and an FCC engineer did really spend his time and our money enforcing this obscure and insignificant flyspeck in the amateur regulations.

Step two of the citation process has been more jolting to those using the ZDI repeater. This machine has an input of 146.61 (honestly!) and output on 147.33 (yep!) with the result that the Tech users, though they are personally transmitting within the Tech band, are being repeated out of band. This brought on more citations from our friendly citation center. The Techs involved answered the citation by pointing out that they were at all times keeping their transmissions within the Tech band. Clearly the persons cited were not in violation of 97.7(c) – yet they have received no further communications from the FCC. The result of this is that those cited are afraid to transmit on 146.61 unless they hear further. Many of those not yet cited are afraid to transmit on 146.61. It is only fair that these chaps get an answer.

When you consider how hard the crew in Washington are working to provide leadership and guidance for amateur radio, it is a shame that problems such as this are souring things at the field engineering level.

The Case for 34–94 Repeaters

Probably one of the most hysterically emotional things that I could write about would be a call for more repeaters on 34–94. I know of no way to get more FMers up tight and furious. I shall write about it.

There is no question in my mind that there is probably more unanimity of mind among FMers on the subject of there not being any more 34–94 repeaters than just about any other aspect of the field. Not only do they not want more, they passionately want the repeaters presently on 34–94 to get the hell off – and now! I'm for more 34–94 repeaters.

Before you put my swimming against the stream down to my well known perversity, would you be at all interested in some of the factors which went into my decision? Well, if you don't even *want* to know what factors are that are involved, then you do indeed have a closed mind. Okay, now you at least will give an eye to what I have to say, even though your mind may be made up, no matter what it is – right?

Consider, if you will, that there are more 34–94 repeaters around the country than any other pair. Note that I asked you to consider this, not draw conclusions from it. Consider also that virtually every transceiver on the market today comes with a 34–94 pair of crystals. There is *no* other channel pair that is generally provided with new transceivers. Does it make sense to have at least one 34–94 repeater in each area of the country?

The fly in the ointment is, of course, the inclusion of a 94 transmit crystal in most of the transceivers, making it so the 94 channel is often used for simplex operation. And, in most cases, where there is a 94 repeater, simplex gets wiped out when the repeater comes on. QRM = anger.

Okay, next step. Obviously both simplex and repeater operation on the same channel are incompatible. Which should give? Should we try to move all of those 34–94 repeaters to other channels, thus giving the buyers of transceivers no repeater to use when they first get their set? It isn't all that difficult for them to get a pair of crystals for the local repeater, so perhaps that is not an important factor. But is it any more difficult for them to get a pair of simplex crystals such as 52?

No other repeater pair comes near being as popular as 34–94. This means that the amateur who travels a bit must have several sets of crystals with him if he is going to use repeaters in the towns he visits. Be honest for a moment please – can you really say that there are *any* amateurs who do not travel? Just about all of us find ourselves in another area of the country at one time or another – and just about all of us want to be able to use a repeater when we get there.

Let's say you live in New York and you have the 13–73 channel set up for using WA2SUR. You go to Boston and you are out of business. Even if you are set up for the other New York channels such as popular WA2KEC on 40–995, you are still cold in Boston – and in Philly – and in Washington – and Chicago and so forth.

Would it really be all that painful to have a 34–94 repeater set up in each major city so visitors would have one common channel to use to get acquainted? Would it really be a big bad deal if travelling amateurs with a TR-22 and its 34–94 channel could know that they would have a channel to use wherever they were? Would it be that bad if HT-220 owners, most of whom have one and one only receive channel, could work a 34–94 repeat-

(continued on page 70)

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TRANSMITTER • RF Output over 1 W • Freq. Dev. adj. to 15 kHz max., factory set to 5 kHz.

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GENERAL • Freq. coverage: 144-148 MHz • 12 channels, 3 supplied • Push-to-talk Xmit • AC drain: Rcv, 6W; Xmit, 50 W • DC drain: Rcv, 0.5A; Xmit, 4A • Built-in Power Supply: AC, 117V 50-60 Hz; DC, 13.5V±10% • Size: 7-7/8" x 2-3/4" x 10-1/4", 8-1/4 lbs.

TRANSMITTER: • Transistorized with 6360 output tube • RF Output: over 10 W • Freq. Dev: Adj. to 15 kHz max. • Freq. Stability: ±.001% or less • Output Imped: 50 ohms.

RECEIVER: • Completely transistorized, crystal-controlled superhet • Intermed. Freq: 1st 10.7 MHz, 2nd 455 kHz • Input Imped: 50 to 75 ohms • Sensitivity: 0.5μV or less/20 dB quieting; 1μV or less/30 dB S+N/N at 10 kHz dev., 1 kHz mod. • Audio Output, 0.5 W • Spurious Sens., > −60 dB.

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The KC4DXpedition

Wayne Green W2NSD/1

One of the fellows on the DX-pedition to Navassa was musing over what it was that made Navassa so interesting a place for a trip. Why not go to Antiqua or some other place? Navassa has the advantage over most of the other spots in the Caribbean – it is seldom hammed – it is awfully hard to get to – no one lives there – the seas are often against you – the weather is hot and the cliffs are awe inspiring. It is a lot different from going ashore on an island with a dock, moving into a nice hotel room with ice water and a restaurant, and setting up a DXpedition.

The intrepid ten, gathered around for a round of beers before going aboard for twelve hours of nausea, sickness and distress.

Ten of us met in Jamaica for the 1972 Navassa Island DXpedition. Eight of the group were from the Atlanta area, one from Philadelphia and Wayne from New Hampshire. Chaz Cone W4GKF made most of the arrangements for the trip, in between his work for IBM. The Philly man was Rick Feld K3FPY, the only dedicated CW man on the trip. Rick runs those 800 watt sound systems used by the top rock groups and swears that his hearing has not been permanently damaged.

Our captain of the Tycoon, Busha, said he had been by Navassa the day before and that the seas were very high at the time and that unless they had subsided we would not possibly be able to land. Great news. All of us managed to get aboard the 41' boat along with about fifty boxes of equipment and supplies and we putted out of Kingston harbor just before midnight. Chaz turned white moments later and assumed his permanent leader position with his head over the rail, a spot which he kept for the next twelve hours. Judging from the convulsions he ran quickly through dinner, lunch, breakfast, and midnight snack the night before before we reached the open sea. He then worked his way back through several days and was about two months back, doing everything possible to dredge up more by the time Navassa hove into view.

Chaz was not by any means alone. The seas were mighty and our little boat went up and down like a roller coaster, smashing suddenly to right or left, nosing into a giant swell, spray shooting into the air. It was a very rough trip and the only winners were the school of fish trailing our boat to pick up the free lunches being left behind.

Chaz Cone W4GKF of Atlanta and IBM who organized the effort and got the license, the Coast Guard permission, etc.

The gear filled all of the bunks in the cabin, leaving only a few chairs and the deck for stretching out. To help more, it was grisly hot in the cabin and this helped aggravate any developing queasiness brought on by the wild ride. To help even more, and probably the most aggravating of all, Neil was there bumbling with a transceiver and making contacts. He'd loaded up one of the fishing outriggers on 75m and the mismatch was so bad that he had to run about 0.5 watts to keep from blowing the final tubes. He did manage to work 6Y5CB up to a couple of miles DX. For some obscure reason he had not thought to bring an antenna tuner.

Rick Feld K3FPY from Philly, a swinging CW op with loads of anecdotes about the rock stars he works with.

Ray Cobb K4PGM of Atlanta, the chef for the party of ten.

Skip Staub K4TMA

Three of us headed for the flying bridge. It was flying around a lot too. We huddled on the seat around the helm and held on for dear life. There was just room to lie down scrunched up, but no way to stay put without grabbing for something every minute or so when the boat would take a particularly steep dive or list. We all spent the night too tired to sit up and too battered to sleep. You might call it aggravated rest. It got us in shape for the strenuous ordeal of moving the ton of gear ashore the next day.

As day broke Busha passed around some saltines for breakfast. Saltines are supposed to be the best thing for a seasick stomach. They were great – soon there were showers of saltine flakes billowing back from the boat looking for all the world like snow as

Steve Smith WA4VWV, another Atlanta pilot and a darned good ham operator.

even that Spartan breakfast was rejected. The heartier stomachs settled for crackers and cheese. Even the best of constitutions were not any too stable after that shaking up.

Busha, asked every one or two minutes by the whiter members of our group, kept answering that we should see Navassa along about 9:20 AM. It is a credit to his helmsmanship and navigation that Navassa appeared dead ahead on the horizon at about 9:17. The Tycoon was making about 10 knots. It could do about double that in calm seas, but any more speed would have pounded the boat too hard.

Navassa got larger, looking like an upside down pie plate floating on the water. The plateau is about 400 feet out of the water. It is ringed by a narrow flat area which is about 75 feet up from the ocean. There are no beaches. The entire island is rocky cliffs and quite impossible to climb. The only spot where the island can be reached is a tiny indentation on the south coast called Lulu Bay where the U.S. Coast Guard has built a landing platform about 35' above the water.

Don Kasten WB4SST, a pilot, of all things. Goes right with his call letters. Don is starting a little ham business on the side to make tone encoders for FM.

There is a wire ladder hanging down from this platform. Since the cliffs are undercut from ten to thirty feet at sea level, utmost care has to be taken in approaching the ladder. One mistake and a swell can shove your dinghy under the cliff and the inrushing sea will smash it and you, spitting out the whole in a shower of spray that goes out about 30 feet.

As we approached Lulu Bay we noted with dismay that the tie down buoy which used to be there had been removed. The bottom is deep and smooth, making anchoring very difficult. The cliffs go straight down about 80 feet under the water and the bottom falls off rapidly to 300 feet or so. The seas were much too heavy for the big boat to get near the ladder and the cliffs. We would have to use the tiny dinghy to go ashore.

Chaz, anxious beyond all description to get his feet on solid ground, went in with the first dinghy trip. Even the spectre of the ladder, which is not at all easy to climb, didn't slow him down in his rush to get on shore.

As self-appointed official photographer for the trip I managed to get into the second trip to the ladder. After being up all night and shaken through and through for twelve hours, I was groggy but game. Somehow I got into the dinghy, meeting it coming up as the big boat went down a swell, grabbed my camera bag, and off we went to the ladder about 100 yards away.

The ladder is a bitch to climb. You have to put one leg around on one side and the other in front or else it will swing out from under you and you then have to chin yourself up the length of it; if you do it right you do get a good workout and some bruises on the legs, but at least you can make it in a minute or so instead of having to rest two or three times on the way up. Just grabbing the ladder takes coordination. If you grab it and hold on while a swell is down the next wave will come up and soak you. If

Bill Donovan WB4WMG of Atlanta.

Navassa comes up over the horizon dead ahead, proof of good navigation by the skipper.

Lulu Bay, the only landing on Navassa, a pork-chop shaped island about three miles long with no beach whatever.

you grab at the peak of a swell and don't hold tight the boat is suddenly six feet below you.

The island wasn't as steady as I wished. I made it to the top of the ladder, my cameras followed me up on a line, and I stood there gathering my wits – or at least half of them. The island was not pitching and rolling as much as the boat and that was nice. Chaz was there, a bit of color beginning to appear around the edges.

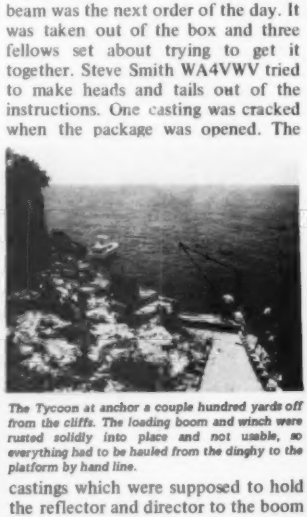
Cameras slung over my shoulder, I headed along the cliffs to get into a good spot to take pictures of the landing operation. The cactus had grown a whole lot since my last visit and I soon found myself stopped to pull off big bunches of it. Balls of cactus clung to my pants, my shoes, everything. Luckily I had worn gloves to climb the ladder and they made it easier to pry the damned stuff off. Only a few thorns went through into my fingers – and broke off.

Since I knew that the fellows would thank me in the long run if I spent most of my time taking pictures of them working rather than stopping the pictures to lend a hand pulling all that gear up the cliff, I tried to ignore the growing chorus of requests for me to come and lend a hand. You know, they reacted the same way the last time I came to Navassa! As the suggestions became a little more pointed I did some token work, huffing and puffing a lot, talking a good deal about how old I am, how often things like this lead to serious heart attacks for those unused to heavy work in the hot sun, and musing over the reaction of the 2000 or so life subscribers to *73* and their reaction if sheer laziness on the part of a couple of expedition members should cause me to expire.

I sure did get an awful lot of pictures.

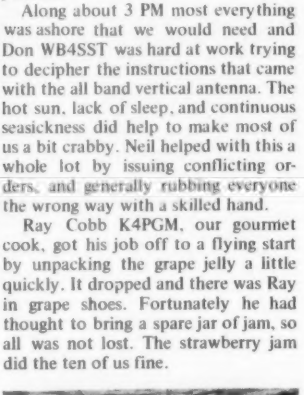
Along about 3 PM most everything was ashore that we would need and Don WB4SST was hard at work trying to decipher the instructions that came with the all band vertical antenna. The hot sun, lack of sleep, and continuous seasickness did help to make most of us a bit crabby. Neil helped with this a whole lot by issuing conflicting orders, and generally rubbing everyone the wrong way with a skilled hand.

Ray Cobb K4PGM, our gourmet cook, got his job off to a flying start by unpacking the grape jelly a little quickly. It dropped and there was Ray in grape shoes. Fortunately he had thought to bring a spare jar of jam, so all was not lost. The strawberry jam did the ten of us fine.



The Tycoon.

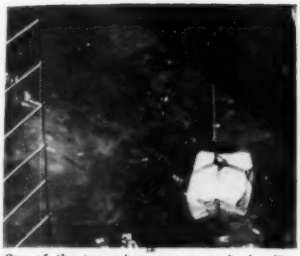
Two of the rigs were set up in short order – Heathkit sets. The triband beam was the next order of the day. It was taken out of the box and three fellows set about trying to get it together. Steve Smith WA4VWV tried to make heads and tails out of the instructions. One casting was cracked when the package was opened. The



The Tycoon at anchor a couple hundred yards off from the cliffs. The loading boom and winch were rusted solidly into place and not usable, so everything had to be hauled from the dinghy to the platform by hand line.

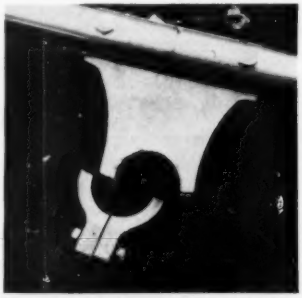
castings which were supposed to hold the reflector and director to the boom were a little small and couldn't be fit to the boom. The cracked casting promptly broke when forced. Some tape saved the day with this. The element was taped to the boom.

Hauling the gear and food up the cliff from the dinghy. Note graffiti all over the place such as the K4IA/KC4 on the side of the walk way and the old brick cistern building above the cliff. That gang sure must have brought a lot of paint.



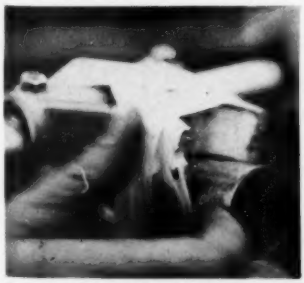
One of the transceivers comes up the handline from the dinghy. Everyone held their breath hoping that nothing would go wrong at this critical stage of the game.

The worst blow of all was when Steve discovered that we had two director elements and no reflector. You can shorten a reflector and make a director out of it, but how to stretch a director? You don't. The result was a beam which we never had to turn at all. Oh, we tried turning it, but never could find out if there was any way to point it that was better than others so we just gave it up.



The casting which was supposed to hold the reflector on the tri-bander boom looked like this when we tried to fit it to the boom.

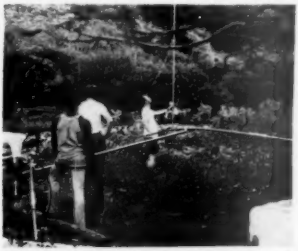
The next kick in the head was when the tribander had been assembled as best we could with the parts furnished and we put it on the end of the 18' mast. Four of us walked the mast up to about 45° when it folded at the top of the bottom section. So we ended up with a 12'' mast. This could not have helped the beam a lot either.



So we used tape to hold the darned element to the boom. There were two directors and no reflector shipped with the antenna, so the beam didn't work.

Under Neil's direction the 75m antenna was swung a couple of feet below the beam. This had the benefit of wiping out the 75m operator whenever the tribander was being used. The 75m dipole wire was stretched out without being unwound, with the result that it took an hour or so to get the hundred or so kinks out of it. And so it went.

The rig that was to work with the tribander turned out not to work, so the Swan rig, which was brought as a spare, was set up in its place. Despite



Richard, one of the boat crewmen, looks on in wonder as Steve hooks coax to driven element. Others are setting up the guys for the mast – which promptly folded in half.

the antenna, it worked and the DX-pedition was on. The pileups built up immediately. All of us did a lot of operating during the weekend and most of us had a ball. It was reported that Neil had taken on the 20m CW station and had managed to work his way through 26 contacts in two hours. I found that I was running about three to five a minute on phone.

We got started operating late Friday afternoon and I spent a good deal of

Don trying to decipher the instructions for assembling the vertical.

the night operating and logging for others, mostly on 20m. I finally managed to get onto a cot set up under a big baobob tree about 5AM as it was beginning to get light. I had to coat myself with a half inch of bug repellant to keep off the swarms of mosquitos. About an hour later the first drops of rain hit me in the face. I yawned and headed to the operating area to help cover the rigs. On my last Navassa visit it had rained about ten minutes during the four days we were

Steve and Phil Latta W4GTS at work figuring out the tri-bander assembly instructions. They sure wish they'd made a practice run on this in Atlanta before getting to Navassa.

there. This time it rained a good half hour and it rained hard. So much for that night's sleep.

Neil set up a folding table as a work bench and opened up his 80 pound box of tools to see about fixing the ailing transceiver. Neil went at it fresh, having had a nice night's sleep in a tent, sleeping right on through the deluge. He needed his fresh for as he started to trouble shoot he found that

Call letters of some of previous ops were painted all over the place. It's no wonder the Coast Guard doesn't like to have hams visit Navassa. Our expedition did not paint anything whatever. Note that the KC4AF expedition in 1958 did not paint anything either.

his vtvm had gone west. He spent a good deal of the day fixing his vtvm. Fortunately he had brought along a back up vom which he used to service the vtvm. He managed to completely disassemble the unit while fixing it. We didn't hear what was actually wrong with the rig, so I suspect it was nothing serious. It was working by evening, thus missing only half of the expedition. Unfortunately, once the rig was fixed, Neil was again available to operate and the screams of anguish

About half a day was spent servicing a vtvm.

from furious operators around the world could be heard echoing forth. There was serious talk of breaking the rig again just to get him off the air.

Neil was pretty crabby most of the time. He had been frustrated over and over. He had wanted to bring along a two meter repeater and set it up so we could all keep in touch via two meters when we walked around the island. This had been vetoed when it was found that the gear would cost 58¢ a pound to ship to Jamaica. He was put out when they made him leave his spectrum analyzer and Tektronix

Chaz operating while Rick, Skip and Don look enviously on.

scope at home. He wanted to bring along one spare for everything on the trip, plus a third for backup. And so it went.

None of the fellows had been on a DXpedition before so they were not really prepared for the realities of the pileups. It is bad enough trying to handle the masses of stations that

The two generators were set up on a concrete patch that connects the landing area at Lulu Bay and the old Coast Guard acetylene building about 100 yards away. Station number two was set up right near the landing area beyond the generators.

want to work you when you have a good strong signal – when you are weak it is murder. One lousy lid with fifty watts and no brains in the States can drown you out. And once you cannot be heard there are enough idiots around to hold down your frequency for hours on end, each trying to be the very, very last in a tail-end race.

The Swan without a remote vfo made it difficult to try and work split frequency. And the weak signal made

Rick took care of most of the CW activity.

it miserable to work transceive. And so it went. Most of the time I worked by call areas, starting with the WB's, then the WA's the K's and the W's. This worked pretty well. Late in the game it came to me that I could do a bit better than this if I worked say three WB's, three WA's, three K's, and three W's in each call area, working my way around the areas a lot faster than when I picked up every single WB, no matter how weak or how bumbling. Next trip I'll try that.

Chaz operating while Bill Donovan logs for him.

I managed to separate the DX stations pretty well by working them according to the number in their call. I had worked out this system in Jordan and it did well. Of course there is no real good answer to the s.o.b. who refuses to go along with this and calls without stop no matter what you say – like EA7IF. There was an HK4 and a PZ1 that drove hundreds of us up the wall too. I sure hope that Chaz does not QSL these stinkers. The next time I run an expedition there will be a place in the log to note that no QSL is to be sent for these inconsiderate

Ray took time out from cooking gourmet meals to paddle some CW.

crumbs. Yes, I know that we had a weak signal and that there are language problems – but is that an excuse for calling for an hour in spite of requests in their own language from neighboring stations to shut up and wait their turn?

One of the systems that worked very well for me and which I also developed while in Jordan was to have a couple other fellows with good signals move up or down the band and make up lists for me. This can flake

The Coleman stove had to work on regular gas instead of white gas due to a gas strike at Kingston. It managed, but had to be coddled. Here is Ray coddling the stove and coaxing it to turn out spaghetti and meat sauce.

out if the band folds, but most of the time it works very well. The big problem for a DXpedition is getting the call letters through the QRM. A list fixes that.

At one time I had too many chaps making lists and I got about a hundred calls behind. This meant that some of the fellows on the list had to wait quite a long time for me to make it to them. I tried to speed everyone up as

Bill Smith has just learned that he is scheduled to log for Neil.

much as I could, but many insisted on spelling out their calls, even though I already obviously had them – others gave their names and locations – etc. I noticed that almost without exception that the German ops would be there, even after an hour of waiting. The Japanese ops hardly ever gave up.

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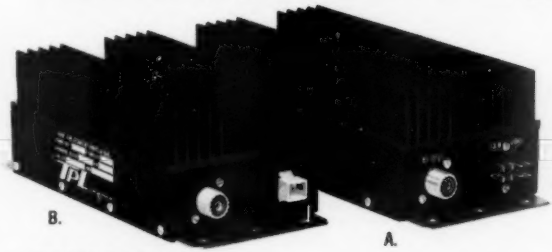

B.

A.

C.

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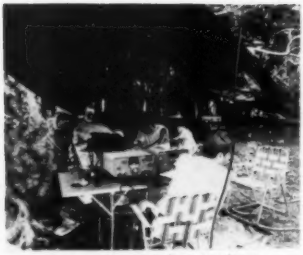


Chaz operating while Steve logs 'em in.

They were right there, no matter how long it took and I worked dozens upon dozens of them, all in the S-2 to S-5 signal range. Without the list I would have only worked a fraction of them.

The band folded to Europe on Sunday morning as I was working my way through a long list – sorry about that.

Now and then someone would get mad and put a carrier on the channel to try and spoil things for everyone. I would stop everything when this would happen and explain to the chap

73 was the favorite reading material around the camp. It was the ONLY reading material around the camp.

that all he was doing was making life miserable for the many fellows that we were contacting and that I would simply change bands to move away if he persisted. This worked every time.

During off moments on Saturday I tried to take a nap on the cot, but the flies paid no heed to the bug repellant and were perversely persistent. There was no sleep. Along about one in the morning I sacked out and fell asleep. The Sunday morning rain started in about 3 AM and I was up again, getting my daily bath. By the time we left Navassa on Monday morning I calculated that I had managed about six hours sleep total from the time I got up Thursday morning. Excitement and nervous energy kept me going. I did manage to grab an hour or so of sleep on the boat trip back.

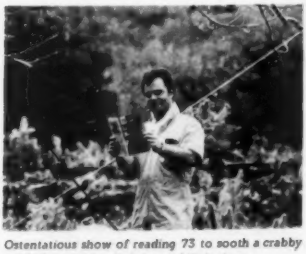
Nothing very rare was worked during the trip. The best I managed was 7Q7AA. Very little from Africa came through. A couple of 5Z4's made it. Not much else. It was a pity that we did not have a couple of good beams along as we had had in 1958 when I last visited the island. That time we brought two beams, rotators and towers. We worked a JT1 last trip.

A short 75m stint was more than frustrating. I enjoy working DX on 75 and I had been looking forward to knocking off a good bunch of contacts on that band. The 75m station was set up next to the tribander and every time the other rig came on the 75m receiver dropped dead completely. Okay, I would have to work through the difficulty and make contacts as I could. The 75m dipole was about eight feet off the ground, so I didn't expect a lot out of it. And the rig wasn't running a lot of power. But I didn't expect what happened.

A low end of 75m was fairly clear. I heard W4JM and some others on there talking about KC4DX and wondering when we would come on. Every time they turned it from one to the other I broke in yelling "break!" After a half hour of this I was close to tears. I tried moving up the band and calling CQ. Nothing. Pretty soon I heard my old friend CO2DL talking to the W4JM roundtable – aha, now I'll make it. I tried again to break the group: no luck. Not once did they ever shut up and listen for a weak KC4DX on channel trying to get through to them – not one time! Two of our group pulled me away from the rig, calmed me a bit, and got me to go to bed to cool off. I didn't make any 75m contacts.

Skip threads his way between the cactus up the slope toward the plateau on a trip to the lighthouse about a mile from camp.

Typical terrain on the island. It did not encourage casual strolling around. Some of those holes went down over thirty feet!



Ostentatious show of reading 73 to sooth a crabby publisher who has had damned little sleep.

Slow Scan DXpedition

Though no one on the expedition seemed overly enthusiastic about my bringing along a little cassette recorder so we could make some slow scan television contacts, one member, Neil, resisted to the last ditch. Even though I had brought along patch cords and different types of connectors so we could connect the tape recorder into

Part of being cook is doing the dishes. Ugh!

A room full of gear ...right here.

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Old donkey engine left from the days of mining postash and guano on the island before WWI. Island used to be German owned, but was taken over after the first war by the U.S. Note Arab-style hat made from towel to ward off sun stroke. It's Wayne.

the mike and speaker jacks, they didn't match the ones on Neil's control consoles and there was absolutely no way that we could mate them. I found this interesting in view of his virtual radio store supply of spare tubes and parts which had enabled him to just about rebuild his VTVM the day before.

Well, no matter. Slow scan is simple to use and we don't even have to connect the recorder to the rig to make do. Before leaving home I set up a menu board with a KC4DX QSL on

Old tracks for mining cars.

it and recorded the slow scan signal on a tape cassette. I brought along a second cassette for recording the incoming slow scan signals. Lacking the patch cords I decided just to put the transmitter mike up to the recorder speaker and do an audio patch. Ditto the recorder mike to the receiver speaker. I hadn't tried it before, but I figured it would work well enough. We weren't after perfection, only success.

I fired up one of the rigs – the one using the vertical antenna. I realized that I had a lousy signal for 10 AM Sunday morning, but that was what was available and I figured that enough fellows would want Navassa on slow scan to clear a channel. I figured wrong.

14,230 was busy with some W6TEZ and others trying to get a JA3 on slow scan. When I came on channel I was asked, not too politely, to get the hell off the channel so they could get their JA. My short fuse was lit. With bad grace I moved down a bit and worked W4MS – no strain – my pictures came through just fine. That was a relief. Eddy had no sooner made his contact for his country number 43 on slow scan than W8YEK called in. I was number 46 for Gene. I'm reasonably sure that Gene is leading in slow scan DXing.

The tape recorder system of working slow scan is not novel. Many slow scanners have only a monitor and use a tape recorded camera signal until they build or buy a scanner. Robot makes up tapes for their monitor customers – and any active slow scanner with a camera will help out and make tapes for newcomers. Buster W9WED uses a cassette recorder to make mobile SSTV contacts.

Tracks go along cut about ten feet deep all the way across the top of the island. This facilitated their dumping guano and stuff into the cars from the surface.

A few more slow scan contacts were made and I found myself out of customers. I moved back to the international slow scan channel and tried to break the group still struggling with the JA3, but to no avail. I moved back down the band and started working the thousands of sidebanders who wanted Navassa.

Late that night Glen W6KZL called on sideband and asked for a slow scan

The first glimpse of the lighthouse from the tracks.

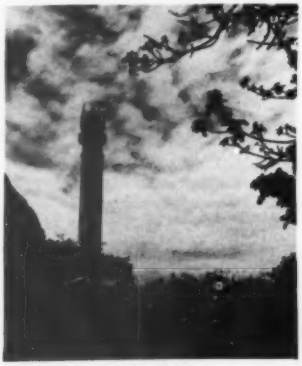
Slow scan television QSL sent from Navassa via a $17 cassette tape recorder and received by W8YEK and photographed from his monitor. The el cheapo battery operated recorder does result in slightly quivery letters.

QSO. I whipped out the recorder and inside of about a minute we had that one buttoned up. In all ten SSTV two way contacts were made from Navassa – a new first, I'm sure.

In June I'll have the recorder with me and try for some slow scan contacts from YK1AA, JY1, OD5 and possibly even SU1IM.

The incoming slow scan signals were recorded and played back when I returned home. They came out just fine! I've since replayed them on the air several times to let fellows see how they came in on Navassa.

When you consider how terribly simple it is to take along a complete



The lighthouse.

slow scan setup on a trip or a DX-pedition, it is difficult to see why this should not be part and parcel of all future unusual operations. You need no camera – you need no monitor all you need is a tape recorder. My unit was one which I bought for $17, so you don't even have to have an expensive recorder.

On Sunday afternoon Skip K4TMA, an Air Force man, and I headed up the hill toward the lighthouse. We picked a poor trail for it and soon found ourselves struggling up a 30° slope covered with what

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Wayne, Bill, Chaz, Skip and Steve rest at the bottom of the lighthouse.

looked like meteorites and cactus. The whole island is made out of swiss-cheese type rock, like a giant solid sponge. You have to watch every step carefully for there are holes all over the place. Some are only a foot or so deep, others go down thirty or more feet and could hold a horse. One unwary step and you are in deep trouble.

We finally got to the top of the plateau which covers most of the island and were met by Chaz Steve and Bill Donovan WB4WMG who had found an easier way up following an acytelene pipeline which had been built in 1962 to power the lighthouse. The lighthouse is now run on batteries which apparently are brought in by helicopter and the pipe line was no longer used. Pity, for they sure did a lot of work putting it in. I feel sorry for the Coast Guard men that had to work at that project.

The lighthouse was firmly chained so we couldn't get into it. We did explore the old lighthouse keeper's building next to it. The roof had burned off this building in the 30's but the cistern was full right to the ground level with water. In '58 it had had water, but we had to reach down about ten feet to get it. That was the time when we ran out of our own water and had to go to the lighthouse to keep from drying up and blowing away. The water looked a little stagnant so we boiled the first batch. This was a lot of trouble so we tried a glass of it on the least popular member of the group and waited to see if he died. He didn't so we all drank it right out of the cistern from then on without bothering to boil it.

This trip we had plenty of water so we didn't have to haul it back the mile from the cistern. Our boat stayed nearby so we were able to get in a lump of ice every day and have iced drinks – luxury. On the last trip the boat dumped us and then left us alone, going to Haiti for a few days to see about a leak, so we had no further supplies possible.

Though I have no complaint about the food on this trip, some of the selections seemed strange. For instance, we had along a rather good supply of powdered eggs rather than fresh ones. I forgot to ask why. It certainly wouldn't have been much trouble to keep fresh eggs on the boat and send in a dozen with the ice every day – or two dozen, for that matter. The powdered eggs came out excellently, spiced with some of those bacon bits – you know, the synthetic bacon. I would think we could have had fresh meat the same way, but instead we had packaged beef stroganoff. Again, it was fine – no complaint. But the whole works was a curious mixture of camping out away from civilization, all the while keeping civilization (ice) with us.

World's deepest privy? With a 400 foot hole under you, it is difficult to bring the necessary concentration for proper use of this fine Navassa facility.

While at the lighthouse I made a contact via two meter FM (146.94, to be precise) with the base station and from there via 20m I contacted K6CKY/4 in Virginia for, I think, the first two meter relay DXpedition QSO. Always something, eh? We didn't need the repeater for the island is small enough so there was no problem in keeping in touch via the little Drake one watt TR-22 units.

Early Monday morning we turned off the generators and packed up to leave. The number of contacts had definitely fallen off, though I am sure that we could have gone for several more days on the bands working the thousands of European and Asian stations that missed us. Perhaps some day we'll be back again – probably with a much better antenna setup and a linear amplifier to make working out easier. I don't think there was more than one chap on the trip that wasn't thinking seriously in terms of going on another DXpedition as we moved the gear back aboard the boat. It was fabulous.

With serious work in sight, I headed for the safety of the adjacent cliff and started snapping pictures of those who were working. The seas were a good deal calmer than when we arrived so the operation went quickly. Even a calm sea at Navassa is something to contend with, so it wasn't all peaches and cream. The little dinghy bounced up and down about four to six feet as it came alongside the big boat, making the transfer of people and the heavier gear chancy. No accidents.

If anyone else is thinking of going to Navassa they may be encouraged to know that we left a nice triband beam there for them. We recommend that they bring along a reflector for it and a taller mast – and perhaps a couple of castings since the sun and weather may rot out the tape in a short while. There didn't seem to be any good

After three days of much operating and little sleep, Don is a little groggy. He wore the cap to fake us all out. Don is now a jet pilot with the call WB4SST.

Phil Latta W4GTS of Atlanta, as seen on Navassa.

Phil W4GTS as seen by Atlanteans.

reason for bringing the remains of that antenna back.

The ride back was a good deal easier than the trip to Navassa and many of us were able to stretch out and get some sleep, at least for a couple of hours. No sickness this time. We did burn out one engine and had to limp back at half speed for the last few hours on the other engine. We just about ran out of fuel oil too, with only a spoonfull left when we docked. The engine quit as we maneuvered into place. Luckily we had "borrowed" some fuel from a passing boat at Navassa in exchange for replacing a fuse in their radio, or we might have had to go into port out by the end of Jamaica instead of heading directly to Kingston.

We all had a quick dinner at a local department store, the only restaurant open at 10 PM, and went off to a very deep sleep. Chris 6Y5CB and his attractive wife were there to meet us and guide us around. Most of us flew back to the U.S. the next morning, though a couple stayed on with their wives for a few more days vacation. By Tuesday night I was back at *73* six days away and another memory for a lifetime for me.

The trip to Navassa was so much fun that it put me back to the map of the Caribbean to see where else a small group might go that would be fun, reasonably rare, and not too expensive. I think I've got it. Would any of you readers like to try your hand at a DXpedition this fall? How about one to Baha Nuevo (HKØ) in late October to coincide with the DX contest? I figure that the whole thing can be done for about $500 per person with ten going. We would leave from Kingston on October 25th and set up on the 26th. The big push would be on the 27-28th, and back on the 29th to Kingston – to the U.S. the 30th. One week of great fun.

This time we would have a place to sleep on the boat going over for it would take about 24 hours to sail that distance from Kingston. We would have two transceivers with beams, one with a good linear, and one spare transceiver with more modest antennas. The beams would be complete with rotators and short towers. I think I can plan the trip and arrange for the equipment. It will be hard work at times, so strength and stamina are required. Any takers?

. . .W2NSD/1

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SLOW SCAN TV: INTRODUCTION AND BASIC PRINCIPLES

You are about to enter the wonderful world of amateur slow scan television. Imagine yourself sitting in front of a radio receiver with a slow scan television monitor plugged into the headphone jack. The screen shows SMØBUO in Stockholm operating his rig from his lakeside cabin. You turn your dial to another frequency on the 20 meter band and observe WØLMD exchanging circuit diagrams with W4TB in North Carolina. These things are now possible with slow scan televsion. It has not always been this way, so let us turn the slow scan history pages back a few years to see how it all began.

In 1958, Copthorne Macdonald, a young engineering student at the University of Kentucky, began an investigation into the possibility of reducing the bandwidth of a wideband television signal to such a narrow spectrum width that it could be sent over a voice communication system. This meant that a 3 MHz television signal had to be reduced to 3 kHz signal – a 1000 to 1 reduction in bandwidth! Macdonald eventually designed a television system that met these requirements. This system used an AM subcarrier, with picture information transmitted as amplitude variations of a continuous tone of constant frequency. The old 11 meter band was used to transmit test pictures since that was the only HF band authorized for picture transmission. The AM subcarrier system proved successful, and circuit details were published in August, September *QST* (1958). Unfortunately, before the slow scan pioneers of that period could build equipment, the 11 meter band was allocated to the Citizen Band Service.

Slow scan television was now limited to frequencies of 50 MHz and above. However, under special authorization from the FCC, it was possible for Cop to perform tests on 10 meters for short periods of time. It was during one of these test periods that Cop WA2BCW, by transmitting "blind" over a period of 30 days, was successful in sending pictures across the Atlantic Ocean to John Plowman G3AST. These tests, and the pictures received in England, were described in March *QST* (1960).

Their imaginations sparked by the transatlantic tests, other amateurs soon began to explore SSTV. Soon, a small group of SSTV enthusiasts were exchanging SSTV audio tapes, and investigating a variety of circuits and standards. An FM subcarrier system was developed (January, February

Fig. I-1. Picture of W9CNW, sent from W9NTP to VK3AHR, 10,000 miles, on 20m. 2.5kHz bandwidth.

QST 1961), and it proved superior to the AM subcarrier system due to its greater immunity to interference from QRM and fading. Since none of the early experimenters were close enough geographically to exchange pictures on the 6 meter band, tests were confined to closed circuit systems, tape exchanges or transmission over phone lines.

During this time the slow scan enthusiasts were attempting to get slow scan (SSTV) permitted on the HF bands. Petition after petition was written, but no FCC action resulted. Macdonald, now WAØNLQ, enlisted the help of several hams in Washington and succeeded in getting a special test period set up at the Rocky Mountain ARRL Convention in Colorado to test the possibility of interference to other hams. W3LJV, W7FEN, WAØNLQ, W9NTP, and WØITB participated in these tests, and for three days visitors at the convention saw themselves on slow scan television either going out over the air or their image being returned over the air from far-off places via retransmitted tape-recorded pictures. It was hoped that other amateurs would hear the signals, form an opinion about their nature and interference potential and let their feelings be known through proper channels. It was during this test that the well-known picture of W9CNW, Figure I-1, was recorded in Australia by VK3AHR with the scheduling help of W9TCT. This test was described in September 1966 *QST*.

As a result of the Rocky Mountain Convention tests, Macdonald convinced both the Navy and the FCC to authorize special SSTV tests on the HF bands. The primary goals of these tests were twofold: to improve the techniques and equipment developed for STTV, and to provide visual communications for personnel wintering over at McMurdo Sound, Antarctica. Fifteen stateside amateurs were authorized to participate in these special tests and Macdonald provided a camera and monitor to KC4USA/NØICE for use in Antarctica. Despite erratic propagation conditions, excellent pictures were often exchanged between Antarctica and the States, some of which were shown in *QST* Feb. 1967, page 77. It is interesting to note that the Navy to this day continues to support the development and use of slow scan, and has recently authorized W4ABY/NØAAJ and W4UMF/NØXTV to exchange SSTV pictures with the *S.S. Hope*.

An FCC proposal of rulemaking permitting SSTV operation on the HF bands was published in November, 1967 *QST* with one month allowed for reply. After this reply period, several amateurs – W2PMV, W9VZL/3, WAØNLQ and W9NTP – went to Washington to review the 30 letters of opposition. Very few of these letters were strong in their criticism, but some letters expressed fears that needed to be studied and resolved. After eight hours of study and discussion these amateurs spent that evening at the home of W9VZL/3 where they wrote answers to the criticisms. This small group felt sure that a slow scan television allocation was just around the corner.

At this time incentive licensing was getting quite a bit of attention by the ham world, ARRL, and the FCC. After about a year with no FCC slow scan television action, fears began to grow again. By making inquiry through the proper channels, we were told that SSTV would be a part of the incentive licensing proposal. The rest is history.

During the summer of 1968, while on a mobile DXpedition to Central America, one of your authors heard the famous words from W7FEN: "Slow scan is authorized on HF." That is how it all came about. Those of you who now enjoy the luxury of operating your slow scan gear have these early pioneers

to thank. Copthorne Macdonald is the inventor, and by his persistent interest finally perfected the system and obtained FCC action to use it.

Slow scan television can be transmitted in all of the advanced and extra portions of the amateur bands. Its bandwidth is confined to that of a voice station which is interpreted to be 3 kHz for single sideband transmission. The 160 meter band is excluded but all the phone portion of 10 meters and VHF and UHF can be used by General and higher classes of amateur licensees. It is of interest that SSTV received more band allocation from the FCC than any of the petitions ever requested.

This is the history of slow scan television. Today hundreds of amateurs throughout the world – in Russia, England, Sweden, Italy, Greece, South Africa, Colombia, Venezuela, Guadeloupe, Puerto Rico, Nicaragua, Canada, Alaska, Hawaii, New Zealand, Australia, Japan, Brazil, Southwest Africa, Belgium, Germany, the continental United States, a total of 28 countries – routinely exchange pictorial information via slow scan television on the 80 through 10 meter bands. And what started as a senior project for a young undergraduate student at the University of Kentucky is now one of the most exciting communications modes within the amateur service.

Basic Principles of Slow Scan TV

Let us explore this new amateur television that was specifically designed by hams for picture transmission on the high frequency bands. Instead of 3 MHz being available for ATV, as in UHF, we are restricted to a 3 kHz voice bandwidth in the HF amateur bands. The bandwidth of a conventional television signal must be reduced by a factor of over 1000 for slow scan. It becomes obvious that both the horizontal and vertical frame rate must be reduced to as low a frequency as possible in order to reduce the bandwidth from 3 MHz to 3 kHz. Resolution of the picture is a prime consideration in choosing the standards Home television viewers may feel that all 525 lines of commercial TV are needed for good TV pictures, but with narrow i-f's, poorly adjusted interlace and other deteriorating factors the actual resolution of a home television receiver is reduced to about 250 lines. As an example, 80 lines per MHz is the computation formula used for estimating the resolution of a 3 MHz i-f system. This is a resolution of only 240 lines. If we now consider that viewing will be done on a small cathode ray tube (available radar tubes), the tube screen size becomes a limiting factor due to beam focus. Everything being taken into consideration, 120 lines were chosen as the maximum number of lines for slow scan TV. It will be shown later that if 240 resolution lines are desired, they can be transmitted in an interlaced format for increased resolution, but such a picture cannot be viewed directly and must be photographed for the increased resolution to be realized in practice.

The vertical frame rate should be as slow as possible consistent with the storage time of the viewing tube. As far as the average ham is concerned, this means the use of a surplus P7 phosphor radar tube since available storage tubes are prohibitively expensive. Tests run over several years showed that 10 seconds was the maximum time of a frame that would permit viewing the frame on a P7 tube with a viewing hood in a normally lighted room.

It is a real advantage to use a horizontal line frequency that is related to the power line frequency. After sampling many viewer opinions and running laboratory tests it appeared that 15 Hz (i.e., 60 Hz divided by 4) was a good choice. 120 lines at 15 lines per second gives an eight-second vertical frame rate. Since these standards have been used by slow scanners in all 60 Hz power countries, it is hoped that they will be maintained indefinitely.

One thing that remains to be demonstrated is the video bandwidth of the slow scan system. Since an aspect ratio of 1:1 seems the most desirable to fit a round radar cathode ray tube, the horizontal resolution should equal the vertical resolution. There are 120 lines division in the vertical direction; therefore, there should be 120 division in the horizontal direction. This is shown in Fig. 1-1. For simplicity assume that every other spot is black alternated with white spots If these spots

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Fig. 1-1. One line of slow scan TV.

are scanned, the output will be a square wave which is formed out of one black and one white spot. This waveform generates 60 complete square waves or cycles in 1/15 second or 60 x 15 = 900 Hz. This means that the maximum video bandwidth is approximately 900 Hz. This analysis is approximate, but is adequate for easy comprehension.

All that remains to be shown is the requirements of the sync pulse standards. We now have a 120 line picture being generated every eight seconds which generates a bandwidth of 900 Hz. Each line must be locked or synced, and each eight-second frame must be locked or synced. In order to choose the proper length sync pulse consideration must be given to the composite spectrum (sync, pulse and video) and how it is combined to be transmitted with good fidelity.

It has been shown that a video bandwidth of 900 Hz, is adequate to reproduce the slow scan 120 line picture. Since the line rate and frame rate is extremely low frequency, a great amount of the video energy is near zero frequency. This means that amplifiers and modulation devices must operate near the dc level. This, of course is impossible since phase shift and drift would cause much deterioration in the picture. The problem can be avoided if the 900 Hz video is modulated on to a subcarrier placed within the 3 kHz FCC allocation for slow scan televison.

This subcarrier is placed at 1500 Hz. In the early days of slow scan, the subcarrier was amplitude-modulated, but extensive testing proved that AM noise created many problems. At that time, it was decided to go

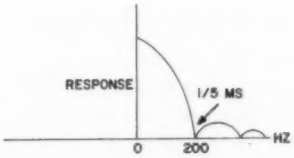


Fig. 1-2. Spectrum of video sync pulse.

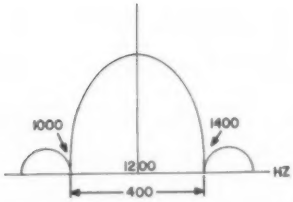


Fig. 1-3. Subcarrier spectrum of video sync pulse.

to an FM subcarrier. Today, the subcarrier operates at 1500 Hz for black video and increases in frequency to 2300 Hz for white video. These frequencies were chosen due to extensive experience with FM subcarrier facsimile transmission.

The sync frequency of 1200 Hz was chosen and represents blacker than black so that the raster is blanked during retrace. In order to separate the spectrum of the sync pulse as much as possible, the length of the pulse is made five milliseconds. Analysis showed that a five-millisecond pulse has a base video bandwidth of 200 Hz as shown in Fig. 1-2. When the sync pulse is modulated or gated on to a 1200 Hz sinewave, the bandwidth is 400 Hz, centered around 1200 Hz as shown in Fig. 1-3. Note that the major part of the sync spectrum does not fall into the major part of the video spectrum which swings upward from 1500 Hz. Finally, the vertical sync pulse is made much wider than the horizontal sync pulse in order to integrate or separate the two pulses. The vertical pulse was made 30 milliseconds long or about ½ a horizontal line. There are some who feel that this pulse should be made a bit longer. This would provide a better vertical sync pulse separation and noise immunity. Most monitors will tolerate longer vertical pulses so there is some room for experimentation on this point.

Let us review the standards for slow scan television:

	60 Hz Areas	50 Hz Areas
Horizontal line rate	15 Hz (60/4)	16 2/3 Hz (50/3)
Vertical frame rate	1/8 Hz	1/7.2 Hz
Horizontal pulse width	5 milliseconds	5 milliseconds
Vertical pulse width	30 milliseconds	30 milliseconds
Sync subcarrier frequency	1200 Hz	1200 Hz
Black frequency	1500 Hz	1500 Hz
White frequency	2300 Hz	2300 Hz
Overall transmission BW (SSB)	3000 Hz	3000 Hz

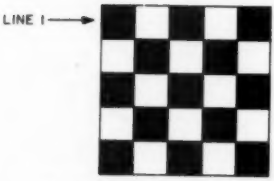


Fig. 1-4. Checkerboard pattern for slow scan transmission. The video signal and sync signals are shown in Fig. 1-5.

As a visual example of pattern generation, consider the following black and white SSTV transmission (shown in Fig. 1-4).

The video and sync signals are shown in Fig. 1-5.

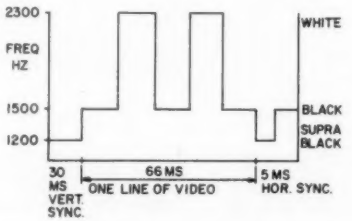


Fig. 1-5. One line of composite sync and base video.

The composite FM subcarrier signal is shown in Fig. 1-6. The composite video signal consists of a midrange audio tone ranging from 1200 to 2300 Hz and is processed in the transmitter and receiver just like a voice signal. If you doubt that a quality picture can have such a restricted bandwidth, visit a slow canner and watch pictures produced from an inexpensive cassette recorder operation at 1 7/8 r.p.s.

Most important in a slow scan television station is the monitor. The photograph of the original slow scan electrostatic monitor is shown in Fig. 1-7. This Macdonald monitor was described in March 1964 *QST*

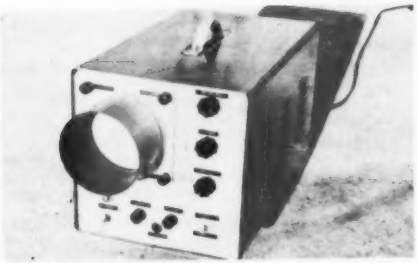


Fig. 1-7. Photograph of original Macdonald monitor (see March 1964 QST).

and this design has become the most reproduced piece of slow scan gear design ever published. This monitor has become the workhorse of slow scan TV, and it is still a favorite by slow scanners who prefer working with tubes.

The principle of all slow scan monitors is the same. Since the audio signal coming from the headphone jack of a radio receiver is audio FM, some means of FM detection must be used. A limiter is required to help eliminate much of the AM noise and QRM that is present on the HF bands. This limiter passes the clipped signal to an audio discriminator. This discriminator can be designed in several ways. The original Macdonald monitor uses a single-sided discriminator, but later in this book several other types of discriminators are described.

The discriminator changes the FM audio signal to an AM signal. It is important to note that the waveform is still made up of the subcarrier centered at about 1500 Hz. In order to recover the 1200 Hz sync signal a tuned circuit sync discriminator can be used to accentuate its amplitude so that the vertical and horizontal sync pulses can be recovered by threshold detectors.

These AM subcarrier signals will require rectification in order to produce the base

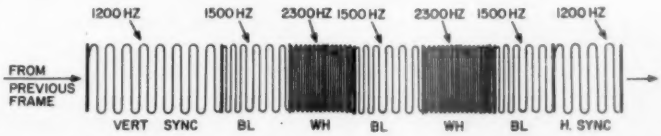


Fig. 1-6. Composite FM subcarrier modulated with composite sync and video. The composite video signal consists of a midrange audio tone ranging from 1200 to 2300 Hz and is processed in the transmitter and receiver just like a voice signal. If you doubt that a quality picture can have such a restricted bandwidth, visit a slow scanner and watch pictures produced from an inexpensive cassette recorder operating at 1 7/8 l.p.s.

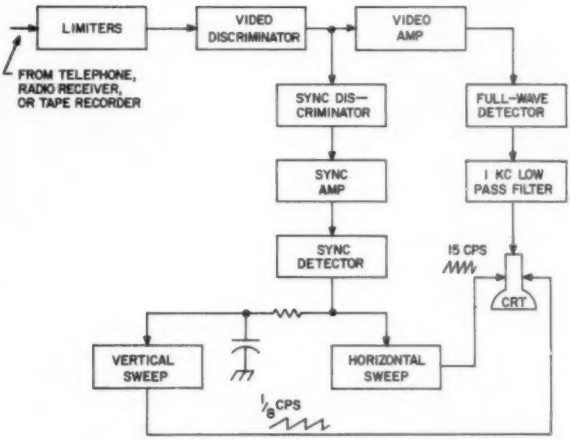


Fig. 1-8. Block diagram of a slow scan TV monitor.

video and sync signals that were generated by the slow scan camera or flying spot scanner. Usually full wave rectification is to be preferred since the low pass filter following the sync and video detector can more easily filter the subcarrier components if they have been doubled in frequency by full wave rectification.

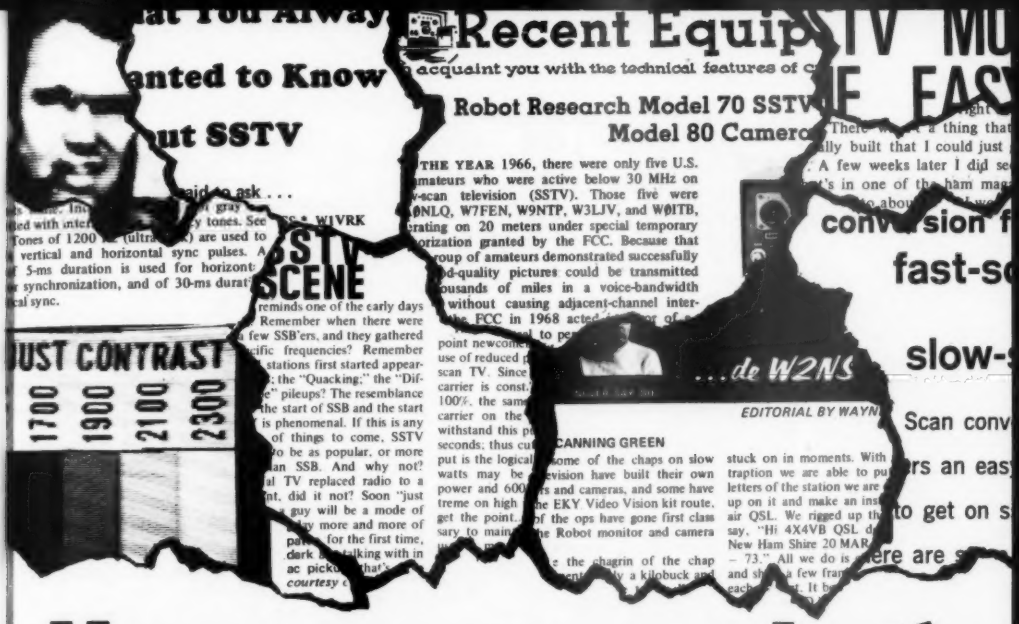
Finally the deflection circuit (whether it is electrostatic or magnetic) is controlled by the recovered sync pulses to produce a raster on the cathode ray tube. The recovered and filtered video is now applied to the Z axis of the cathode ray tube to produce a slow scan picture. A block diagram of the slow scan monitor is shown in Fig. 1-8.

The generation of a slow scan television picture can be done in several ways. The simplest method for the transmission of slides, photographs, and circuit diagrams is the flying spot scanner. There are two designs of the flying spot scanner shown in later chapters of this book.

To utilize the flying spot camera to produce TV signals from film negatives or positives, it is necessary to generate a raster. A raster results when a sawtooth electrical signal is connected to the horizontal and vertical plates of a cathode ray tube. The two sawtooth voltages applied to the horizontal and vertical plates differ in frequency; so for one cycle of vertical deflection, several hundred deflections occur in the horizontal direction. The grid of the cathode ray tube is adjusted to produce a constant brightness spot on the face of the tube. The overall result is a white illuminated square or rectangle on the face of the tube made up of several hundred very nearly horizontal lines.

A flying spot raster on a home TV set can be produced by turning the contrast control fully counterclockwise until no trace of picture results. The brightness control is then adjusted clockwise until a white constant brightness rectangle results. This image is called a flying spot raster. A similar white rectangle is produced for slow scan television, but from different frequency sawtooth voltages. How do we produce a TV signal from this raster? It is important to remember that the raster has been synchronized in both horizontal and vertical directions by a timing circuit that starts the beginning of each sweep. The flying spot or beam is therefore in a precise location on the face of the cathode ray tube at any instant of time.

If a transparent negative or opaque positive picture is placed directly on or near the face of the tube, the light that passes through the transparency or that is reflected from the opaque photograph will be modulated by the density of the



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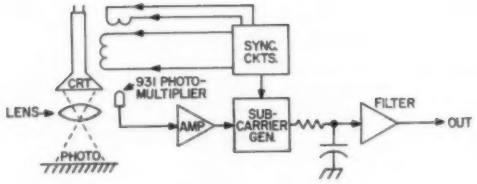

Fig. 1-9. Simple magnetic flying spot scanner.

photograph. It is now possible to place a light sensitive device (photo-multiplier) in the front of the tube, and the resulting electrical signal called video is synchronized automatically with the flying spot raster. The pulse sync signal is combined or added to the video to produce a signal that can be used to paint a picture on the screen of a distant TV set. It is important to remember that the sync signal always occurs when the beam flys back to its start during retrace; therefore, the video is not affected. A block diagram is shown in Fig. 1-9.

The principle of the flying spot scanner is useful for both fast and slow scan. Commercial TV stations have used FSS for advertising breaks. In the case of slow scan, the TV signal must be further processed before transmission. The video frequencies are so low that a subcarrier is needed to help the transmitter pass the slow scan video.

The slow scan enthusiast has several very good live cameras to choose from. Originally when Macdonald designed the shuttered 7290 slow scan camera, vidicons were given out by Westinghouse for experimental uses. Slow scan has grown greatly since it has become FCC-authorized in the Advanced and Extra class amateur phone segments.

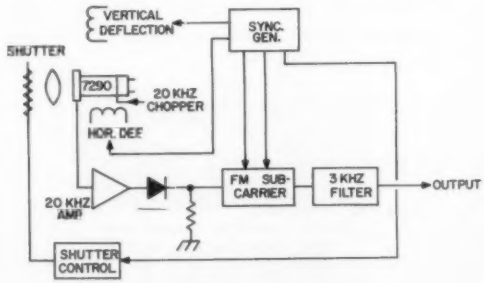

Fig. 1-10. 7290 shuttered camera.

Free vidicons are no longer available but can be purchased from the same source for $100. This price is far below the selling price of this vidicon for commercial use. The slow scan 7290 vidicon target can hold an electrical image for several seconds once it has been exposed to an image. In the 7290 SS camera shown in Fig. 1-10, an electrically-operated shutter exposes the target for about 1/30 second and then the image is electrically scanned for the next eight seconds. Similar to flying spot scanners, the vidicon beam must be swept in horizontal and vertical directions by the 15 Hz and 1/8 Hz sawtooth voltages to produce video.

The signal from the 7290 vidicon target is a very low frequency audio signal and requires much amplification. Audio frequencies near dc are very difficult to amplify because of limitations of coupling and by-pass capacitors, so a technique of chopping is used to electrically change the signal into an ac wave. A 20 kHz sine wave applied to the vidicon grid will turn the scanning beam off and on at this rate so that the small target signal can be amplified as a 20 kHz signal. Once the amplification is completed, the 20 kHz signal is rectified and the resulting signal is the amplified low frequency video or audio signal desired.

The vidicon is provided with the dc operating potentials usually needed and provision is made to blank the vertical and horizontal beam during retrace.

Due to the lack of 7290 vidicons, early slow scan pioneers tried to substitute ordinary fast scan vidicons such as the 7735A and 7038. Contrary to the opinion of those acquainted with the chemical and electrical make-up of these tubes, some slow scan hams were able to get reasonable pictures with *open shutter* operation. K7YZZ and WB8DQT have investigated this type of picture generation thoroughly, and have provided many good pictures on the slow scan net.

About this same time slow scan hams in Europe (such as SMØBUO) were successful in using plumbicons in the Macdonald circuit in the open shutter mode. This proved to be very successful and hams such as W4YHC,

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Most of the many hundreds of SS TV'ers now active on the air agree that the full excitement and enjoyment of SSTV can best be realized only when a tape recorder is part of the system. Incoming pics are taped for future viewing on SS monitor—pre-taped pictures, scenes, I-D—can be transmitted. So—exclusive!—every **SBE Scanvision monitor has a cassette-type tape recorder built-in**—wired—ready to go and selectable with panel switch. Here is the ultimate in convenience.

SBE Scanvision is conservative—reliable, with picture-proved circuitry and is all solid-state except for the scope tube in the monitor and the videocon picture pickup tube, heart of the SB-1CTV camera. Both tubes are standard types with predictable characteristics—not surplus.

High quality is everywhere evident—throughout, the to-be-expected **SBE approach**—fastidious— professional. The **SBE Scanvision,** SB-1MTV Monitor, complete with casette recorder and SB-1CTV Camera with f/1.9, 25mm lens, connect with patch cable to comprise a **system.** Units are also separately available.

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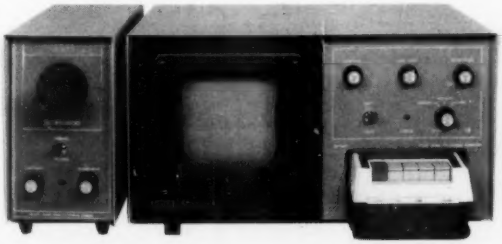
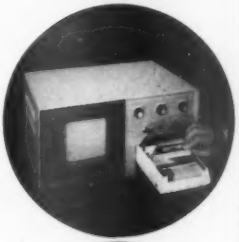


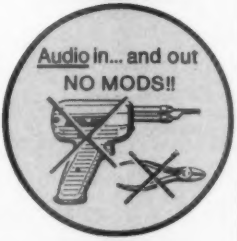
Fully meets all accepted SSTV standards. Compatible.



Exclusive! Built-in, casette-type recorder. Ready Instantly

Available—camera with high quality videocon for "live" or "still" pics.

Camera is supplied with quality f/1.9, 25 mm lens. No extra charge.



Monitor connects to spkr or phones for receive—to mic input for transmit.

"Live" SSTV pic photographed from monitor. Unretouched.

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Fig. 1-11. Sampling method of producing a slow scan picture.

W7ABW WØLMD, and others have produced some excellent pictures using the Phillips plumbicon. These tubes are available as pull-outs from color cameras here in American and are available at TV stations in some parts of the country. Plumbicons, with their relatively high target resistivity are quite effective at slow scanning rates and represent an excellent alternative to the 7290 in the open shutter mode. Last but not least comes what the authors consider to be the best type of slow scan camera – the sampling camera. All of the above cameras (with the exception of the 7290 camera) require open shutter and therefore the subject being televised must remain nearly immobile for the eight seconds. In practice this is not very difficult and contributes to some of the fascination of slow scan TV in which special effects can be staged.

In principle a sampling camera operates like sampling oscilloscopes. The operating principle is based on the fact that the picture being sampled does not change over the length of time that it takes to sample moving fast scan frames. In this case, the time is eight seconds. Assume that a fast scan camera is operating with the following standards: vertical frame rate – 15 Hz, and horizontal line rate – 15,750 Hz. Note that a normal fast scan camera operates with a 60 Hz field or frame rate!

It is assumed that the video will be sampled at every line crossing as shown in Fig. 1-11.

By slowly moving the sampling point to the right at a 1/8 Hz rate, 120 vertical lines are formed. A slow scan sampled picture is generated in this way. This picture is on its side and the electrical signal needs to be filtered, but it is identical to slow scan pictures produced in other ways.

From a circuit designer's viewpoint, the functions that need to be generated in a sampling camera are as follows:

1. a 15 Hz sawtooth sweep voltage locked to 60 Hz mains.

2. A 1/8 Hz sawtooth, preferably locked to 60 Hz mains or to the 15 kHz horizontal sweep voltage.

3. A 15 kHz sawtooth to sweep the fast scan raster. This sweep does not necessarily need to be locked to other time bases and is available from the fast scan camera.

4. A circuit that provides the timing necessary to do the sampling that moves in time across the raster.

A block diagram is shown in Fig. 1-11.

Part II, next month, will cover popular SSTV circuits.

...W9NTP & WB8DQT

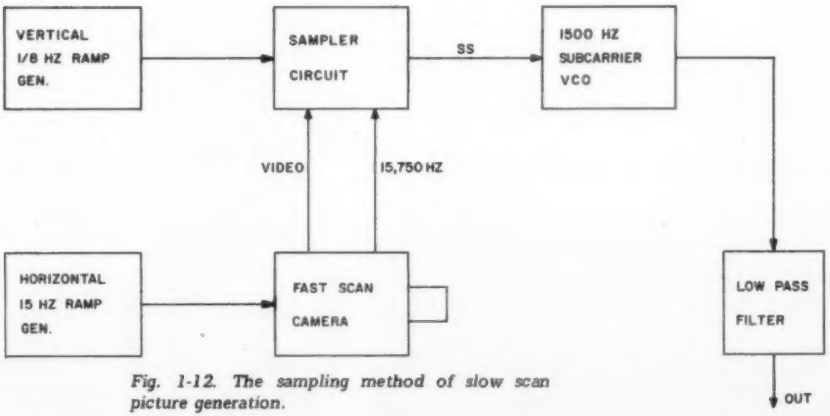


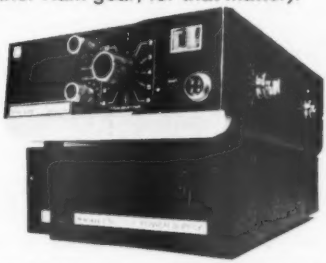
Fig. 1-12. The sampling method of slow scan picture generation.

Don't be misled by:

"WHAT YOU SEE IS WHAT YOU GET,"

when buying 2 meter FM equipment (or any other Ham gear, for that matter).

SWAN ELECTRONICS gives you much more —a lot of which you can't see!



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A Versatile Premodulation Speech Processor

Since the early 1940's, when audio clipping first appeared as a method of overmodulation prevention, premodulation speech processing has been the subject of ingenuity and controversy. As a means of increasing the "talk power" of AM transmitters, it gained considerable popularity. More recently the audio compressor has almost displaced the clipper due to its inherent low distortion. For sideband applications it has been demonstrated that heavy premodulation speech clipping is unsuitable[1],due to the transients produced by heavily clipped peaks.

While a number of systems for clipping the sideband envelope have emerged, these require either breaking into existing transmitter circuitry (unacceptable to many owners of commercial units), or the use of a complex and expensive external unit.

The simple solution for SSB operation is still the speech compressor. In the past several years the author has breadboarded just about all of the transistorized compressor circuits published in the ham press, and tried them out on the air with varying degrees of success.

The two major limitations in compression applications were found to be (a) difficulty in maintaining close to 100% average peaks without initial syllables overshooting, and causing bad flat-topping; (b) excessive mike sensitivity when using maximum compression.

Since all compressor circuits utilize some form of feedback control of gain, it follows that there is a finite time constant involved in controlling initial input peaks. Even if this "attack time" is very short, the first syllable following a pause can result in a substantially higher peak than those immediately following. If compressor output is reduced to maintain initial peaks below the 100% level, then compressed peaks will be well below the transmitter maximum output capability.

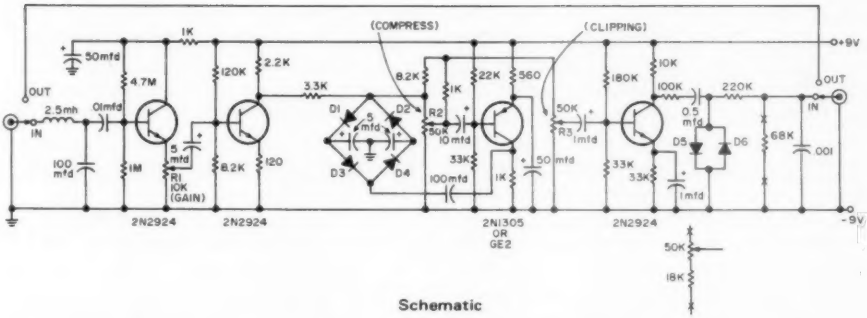
In addition, the gain of the compressor is not proportional to the input, but varies in a non-linear manner, ideally logarithmically. Thus weak sounds receive considerably more amplification and when 20 db of compression is applied, mike sensitivity will increase as much as 10 times that of normal. Unless the operator enjoys the advantage of a soundproofed studio, the resultant background noise and room echo can be very undesirable. In actual practice with the normal ham-shack environment, the amount of compression must be held well below the maximum attainable, and the benefit obtained is something less than spectacular.

Together, both the above limitations tend to reduce the effectiveness of compression. Results of trying different circuits had been disappointing in comparison to the added punch achieved with good clipping to an AM transmitter.

In reviewing both types of circuits, it was decided to try and combine the advantages of each. Actually this is not a new approach, since broadcast stations have long applied a combination of compression to maintain constant program level, followed by moderate clipping to positively limit overmodulation peaks.2 a number of published circuits were tried in different combinations, with the following performance requirements as a target:

Compression: 0 to 20 db, adjustable.
Clipping: 0 to 10 db, adjustable.
Hi-Z input and output.

The final circuit shown is based upon a



Schematic

compressor design by W. Henry[3], and a clipper circuit appearing in an issue of 73 [4]. The combination allows the optimum mix of compression plus clipping to be applied. Either compression or clipping may be used alone if desired for other than SSB applications.

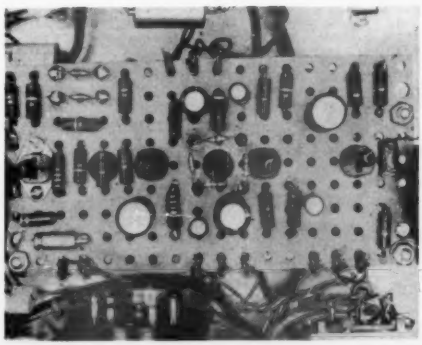
A brief review of the circuitry shows that Q1 is a conventional emitter follower, providing a theoretical input impedance of 250K. This figure will be somewhat lower, dependant upon the exact Beta of the transistor used. At any rate, it will be in excess of 100K, providing the desired load for most Hi-Z dynamic or reluctance microphones.

Q2 and Q3 comprise the compressor section, which has excellent control characteristics, while being able to handle an unusually large range of input signal without overloading. Utilizing the characteristics of diodes D1 and D2 as a variable attenuator, controlled by a DC bias current provided by D3 and D4, the wide range of attentuation available results in almost complete cut-off of output in the presence of excessively strong inputs. Q2 functions as a conventional amplifier, while Q3 provides variable control signal which is rectified by D3 and D4. A unique resistive network acting in conjunction with the compression control R2, maintains virtually constant max peak output, regardless of the setting of the compression control. Time constants in the original circuit, resulted in a release time of approximately one second, consistent with tape recording applications. Time constants were modified to produce a release time of about 100 miliseconds, in order to closely follow the syllabilic rate.

Compressed audio is fed to the inp ut of Q4 via the clipping control R3. Q4 functions as a straight amplifier raising the level to that required for clipping by diodes D5 and D6. The 100K resistor in series with the clipping diodes prevents them from loading down the output of Q4. With the clipping control set to maximu, peak output from the compressor section will be clipped about 10 db. The RC network following the diodes provides a roll-off above 2,500 hz, and filters harmonic components created by the clipping.

Construction

Most everyone has a favorite approach to the construction of a device like this, and the processor has no critical requirements as to layout, providing that normal good practices are followed. The prototype was assembled on a 5" x 2½" piece of perforated board, utilizing good mica filled transistor sockets to permit trying various transistor types. For more permanent construction, perforated board with .062" holes is recommended, using flea clips for mounting com-



ponents, including transistors. Transistors of the economy type were chosen, but other types with similar characteristics may be substituted if they are available. Diodes D1, D2, D3 and D4 should be the types shown to obtain the right attenuation characteristics. These are now inexpensive types and readily available from leading distributors. Diodes D5 and D6 are particularly recommended for their clipping capabilities, though other silicon types will work. The 2.5 mh input choke is considered a must. Some early reports of distortion prior to incorporating this choke, proved to be due to rf feedback. The additional gain of this unit makes it particularly susceptible to rf pickup on higher frequencies.

The output of the processor is about 150 mv peak, which is quite a bit higher than the average mike level. In most cases, however, this can be compensated for by the transmitter mike gain control. In those rare instances that it cannot, or if the operator desires to retain the same mike gain setting with the processor in and out of circuit, the optional output attenuator may be substituted for the 68K output resistor.

If the processor is to be used only with a microphone in the -45 db to -60 db range, input control R1, is not absolutely necessary and may be replaced with a fixed 10K ½ watt resistor. However, if high level inputs, such as phone patch or tape recorder are contemplated, the input control will be useful to prevent overdriving the base of Q2, and should be set so that no distortion occurs. For mike use the input control may be left at maximum.

The clipping control R3, and the output attenuator (if used) need only to be set up once for a given mike and transmitter. These controls may therefore be incorporated as screwdriver adjustment types, leaving only the compression control for panel adjustment, so that compression may be changed to suit individual operator voices and conditions.

Using the Processor

Much of the comment that has been heard over the air relative to the detriments and distortion resulting from use of this type of device stems, I believe, from incorrect adjustment. The chief mistake is trying to get too much by cranking in all the available compression or clipping, resulting in bassiness and degradation of speech quality. So better to start off by using too little rather than too much.

The following procedure is suggested when first setting up the processor with your mike and transmitter.

Set the processor controls as follows:

Input Gain—Max. clockwise.

Compression—Min. (fully counterclockwise)

Clipping—Max. clockwise.

Speaking into the mike with normal voice level, adjust the transmitter mike gain for normal modulation peaks. If the optional output attenuator is incorporated, then the transmitter mike gain should be left at its normal setting and the output attenuator adjusted for normal modulation. Having established the transmitter input by one of these methods, slowly rotate the clipping control counterclockwise while continuing to talk into the mike, and observe the output peaks. For a part of this rotation no change in peak swings will be noted, but a point will be reached where peaks begin to drop. This is the clipping threshold. Reset the clipping control slightly above the threshold point. Finally, advance the compression control noting that, while maximum peak swings do not increase, modulation troughs become shallower until the needle of the output indicator will "hang" within 80% of maximum. Optimum setting of the compression control will have to be determined with some experimentation, and may be varied for different conditions. As used by the author, the control is set between 12 and 3 o'clock dependent upon conditions. For local contacts the compression control may be set at minimum, leaving only the light clipping to prevent overmodulation.

Always remember that the processor is supposed to boost the weaker voice sounds and adjust for variations in speaking level, or distance from the mike. If you get reports of boominess or room noise you're overcompressing.

After you get it satisfactorily set up, you might want to increase the clipping control a bit more, but not so that obvious raspiness occurs.

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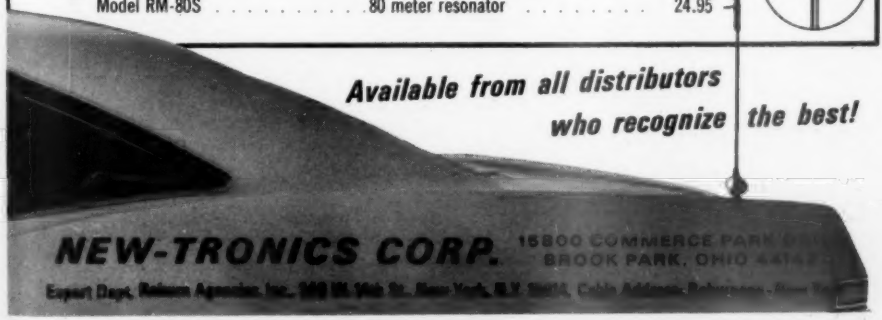

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Results

And now to the prime question, "What will it do for me?" No, it won't substitute for a linear or a beam, but properly adjusted it will give added punch and intelligibility that can make the difference between being poor copy or Q5 when the going gets rough. Needless to say, it adds nothing when your signal is 20 over S9.

In support of this claim I can say that the processor has been used on the air for several months, and has been subjected to many tests with other stations.

Used in conjunction with a Galaxy V Mark 2 transceiver and a Shure 444 microphone, each test has consisted of several transmissions with the processor in and out of circuit, with identical peak output being maintained on a monitorscope.

While it is obvious that no form of premodulation processing is going to increase peak output, many stations have reported an *apparent* increase of 1 to 2 S points when the processor is cut in. This is obviously caused by the AGC time constants in the receivers responding to the higher *average* signal, and has been most noticeable with receivers using audio derived AGC.

In all cases, stations worked have reported a significantly louder signal with processor in circuit. Under S2 signal conditions, 50% copy was reported without the processor, and 100% copy with it.

. . . W6AJZ

Bibliography

1. "Speech Clipping for Single Sideband"; W. K. Squires & E. T. Clegg; *QST*, July, 1964.
2. *Radiotron Designer's Handbook*, Langford-Smith, Chapter 16, 2 (vi). "Volume compression plus limiting."
3. "Tape Compressor"; Walt Henry, *Electronics Illustrated*, July, 1966.
4. "Clipper/Preamplifier"; Jim Fisk W1DTY; *73 Magazine*, March, 1967, p. 5A.

Other References

"Premodulation Speech Clipping and Filtering"; W. W. Smith W6CBX, *QST*, February, 1946.
"A Clipper-Preamp. for A. M."; Gary Blake Jordan WB6MOC; *CQ*, July, 1966.
"RF Clippers for S.S.B."; William Sabin WØIYH, *QST*, July, 1967.

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A Two Buck Signal Generator

Modulated FM yet.

The circuit in Fig. 1 is as simple a modulated transmitter as can be built. It has been useful in testing two meter FM receivers, alignment, (rf/i-f peaking) and as a short range transmitter. When used as an FM transmitter or wireless mike the range without an antenna is 100 yards plus and the audio is excellent. The components may be wired on a terminal strip or soldered to a small (2 x 2 in.) piece of copper clad board and then installed in a small minibox with the end cut out. The box will eliminate frequency shift due to hand capacitance and the open end will allow the signal to radiate directly from the tank circuit. If you must go first class, a one turn link coupled to the tank coil, one end to ground through a 5–20 pF capacitor and the other end to a pin jack will allow you to have a completely enclosed box with a plug-in whip antenna.

Construction

All leads should be kept to a minimum, and with short leads be sure to heat-sink the transistor and varactor leads when soldering. The varactor is from Poly Paks, 25¢ available in packs of four. The transistor is a Motorola MPS6512. The mike is an 89¢ lapel mike (crystal). If only an rf signal is needed for alignment purposes the mike, varactor, and 2 pF coupling capacitor may be eliminated. The coil for 147 MHz is two turns No. 16 wire ½ in. diameter and ½ in. long. A ½ x ½ in. hairpin loop will put you in the 432 MHz range. If modulation is used do not exceed the 2 pF value for coupling to the varactor.

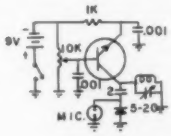

Fig. 1.

Three or four turns of hook-up wire as a gimmick capacitor works nicely. In the interest of slower tuning you may wish to parallel the tank capacitor with a small piston trimmer and use the 5–20 pF as a band set. An alternate method would be to mount the coil on a brass, slug-tuned coil form and tune with the coil slug.

Based on letters from past articles, parts appear to be a problem in some areas. I have a quantity of MPS6512 available for 90 days after this issue at 25¢ each plus an SASE.

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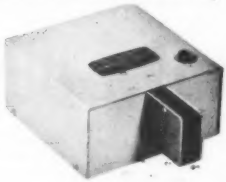

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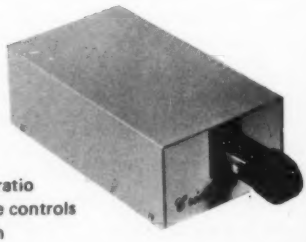

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transmitters THEN and *NOW*

I can remember, way back in the dim dark past, when I was a Novice, seeing an article by W1DBM in which he showed how an old carbon filament light bulb could generate sufficient rf to cause a troublesome level of TVI. Thinking back on that today, I can't but imagine the stir it might have caused back in the time this type of bulb was in style. Amateur transmitters in that time were weird and exciting, as well as noisy. A kilowatt rig made so much noise it had to be muffled in a special box.

Most of us like to believe that Marconi "invented" radio waves. Frankly, he didn't. He didn't even discover them. As one old-timer put it, nobody really invented these things. They were there all the time waiting to be discovered. That was the case with radio waves. Long before Marconi's parents even so much as held hands and Hertz was still toddling around in short pants, another man was hitting awfully close to the right idea.

His name was James Clark Maxwell. Born in Scotland, he was as a boy so fanatically interested in science that his schoolmates nicknamed him "Dafty." When he was barely in his teens, though, he was turning out scientific writings that made the experts sit up and take notice. As a man of forty, he had the distinction of being appointed to a professorship at Cambridge, England.

In 1873 "Dafty" came up with the startling theory that electricity and light were similar in nature, and that they were waves. Now, a wave is defined as a vibration of a substance. Sound, for instance, is the vibration of air. Maxwell had to define the substance through which light traveled.

He called the medium ether. The word ether had long been used to describe the substance of which space is composed. Maxwell accepted this theory, and offered

the theory that light waves were merely ripples in the ether. Now all he had to do was produce these ripples artificially. Only death could stop him, and it did.

Heinrich Hertz had grown to manhood by then, and was lecturing in the University of Kiel. He was intensely interested in Maxwell's theory, and there were many entries in his diary; "Thought about electromagnetic rays. . .Hard at Maxwellian electromagnetics. . .Nothing but electromagnetics." In the Kiel high school library, there were two coils of wire, each with a spark gap across it. One day, as he discharged a Leyden jar through one coil, he had a spark jump the gap in the other coil. Hertz experimented with this phenomenon for eight years. Using home-made equipment and working in the school lab after classes were over, he managed to transmit impulses over a distance of about forty feet. Small as this distance may seem, it was enough to enable Hertz to verify many of Maxwell's theories. Building huge curved mirrors and prisms, he demonstrated that the electric waves could be reflected and refracted the same as light waves. By the time he died in January, 1894, the world had a sound knowledge with which to start the development of wireless. Hertz himself had no idea of what he had started. When asked whether or not his waves would ever be used for telegraphy or telephony, he said he didn't think it would ever be practical.

Hertz's transmitter was very simple –merely a spark gap in a large loop. When another loop of the same size was nearby, a corresponding spark would jump in the receiver loop. Before it could become practical, a more sensitive receiver and a better means of producing the waves had to be developed. When Branley's coherer was developed the world was ready for Marconi.

Marconi began experimenting with Hertzian waves around 1895. He used a very similar transmitting apparatus, except that he added an antenna and ground. Much of Marconi's success, however, should be credited to Branley's coherer. It was the start of the age-old problem, "You can't work 'em if you can't hear 'em." By the spring of 1897, he had filed a patent for "signaling through space without wires." In July, 1897, the Marconi Wireless Telegraph and Signal Co. was formed, and the radio industry was on its way. Lloyds of London asked Marconi to install equipment in two lighthouses on the North Irish coast and instruct the keepers in its operation; thus the first practical use of wireless was launched.

One of Marconi's big problems was separating signals one from the other – that is, the problem of tuning. That meant that the receiver should be able to accept signals from one transmitter and reject all others–a simple enough accomplishment today, but in that day, resonance was unknown. Marconi called the condition "Syntony." With the help of Sir Oliver Lodge, who, by the way, had helped Marconi before in the development of the coherer, syntony was achieved and patented by 1900.

One of Marconi's helpers, Ambrose Fleming, had developed a receiver using a "valve." This first vacuum tube relied on a phenomenon which Edison had noticed some years before, but not patented. Fleming scooped Edison on the patent of this device, but Edison had his revenge. He had a prior patent on the aerial and Marconi had to pay for rights.

For the first couple of decades, most of the development in radio techniques was confined to receivers. Transmitters remained basically quite simple–a spark gap connected to an antenna. In Marconi's first rig, he used a transformer similar to the ignition coil of an old Model T Ford. The primary power was supplied by batteries through an interruptor similar in principle to an electric buzzer. Zinc was preferred for the electrodes, although brass or copper could also be used. One electrode was grounded, and the other connected to an antenna through a series inductance. The inductance was slide-tuned. That's all there was to it. This circuit was still around in 1920, although an old book says, "The government authorities are not inclined to grant a license to operate the transmitter in Fig. 12, unless it be of a low power and located in a region where it is not apt to interfere with the working of government or commercial stations." This was in 1920.

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and coupled the antenna inductively to the transmitter. The coils were still slide-tuned, although a capacitor was sometimes inserted in series to correct the aerial "if its natural wavelength exceeds 200 meters."

Most of the spark transmitters utilized an ac spark. The resulting rf was therefore modulated at the ac frequency. This made it possible to hear the signals with a crystal receiver, when they would otherwise have been inaudible. The hissing crash of the spark could be heard far from the operator's shack. The spark itself occurred between the ends of two metal bars about 1/16 to 1/8 inch apart. The bars were equipped with fins to facilitate cooling. The hot ends were generally flat, although pointed ends would spark more easily. Flat ends would quench better between cycles of the generator, giving better modulation. The generator frequency was preferred to be around 200 to 400 Hz, since operators preferred a nice musical note. As the art developed, ways were found to better govern the frequency of the spark.

One way was the rotary gap. In a rotary gap, a conductor was spun between a number of points, making and breaking the gap at a pleasant-to-hear frequency. There were two types of rotary gap, namely synchronous and nonsynchronous.

The difference was simply that the rotating member was, in one instance, mounted directly on the generator shaft, so that its spark always occurred at the peak of the generator's cycle. Of course, this required the generator to have an output frequency the same as the modulation frequency. In the cheaper nonsynchronous spark, the tone heard at the receiving end would be a composite of the gap frequency superimposed on the generator frequency. This gave a rougher note to the receiver.

Quite surprisingly, the principle of an LC resonant circuit was applied first to the step-up transformer between the generator and the gap, rather than in the rf portion. In fact, the early books seldom even show an LC resonant circuit in a transmitter until vacuum tubes entered the picture. They were, of course, used in receivers almost from the beginning.

One other form of the spark gap was the multiplace, or "quenched" gap. This consisted of a number of copper disks, separated by insulating washers, mounted between the electrodes. While this was a more efficient rf generator, it lacked the musical sound of the rotary gaps. However, if the power supply was at a high enough frequency, it was quite satisfactory.

Finally, it is worth mentioning that every radio shack had a "test buzzer." This was a common electric buzzer, sometimes equipped with a tuned circuit, which could be connected to an antenna. Its function was the same as signal generators in today's radio-TV repair shop. The buzzers were quite efficient. One account states that, when connected to an antenna, they could be picked up several miles away.

Most of the tuning of these early transmitters was done inductively. In the earliest models, the main frequency-determining element was the antenna, together with an inductance at the transmitter end. One interesting sidelight is the use of the centimeter as a unit of inductance. One centimeter equaled 0.001 μH. Eventually, as the state of the art improved, and the nature of radio signals was better understood, capacitors began to be used. They were first used in receivers, though, and for good reason. The voltage required to produce a good reliable spark ran well up into five figures, and even today you can seldom find a capacitor that will withstand that kind of voltage.

Around 1903, a Danish engineer by the name of Valdemar Poulsen tackled one of the hairiest problems in this fast-growing art. Spark transmitters, you will remember, were powered either by an interrupted direct current or by alternating current. With each pulse of the direct current, or with each half cycle of the alternating current the rf would appear as a series of damped waves. While this served to make the signal audible, it nonetheless wasted a lot of power and rapidly lost its readability as the distance increased.

Poulsen's approach to the problem was to devise a gas-enclosed dc arc. Now, here one should realize that there is a difference

between an arc and a spark. A spark is a sudden, discontinuous discharge, while an arc is a sustained discharge. An arc needs a high dc voltage to start it, and can then be sustained by a comparatively lower voltage, while a spark is constantly making and breaking at the supply frequency. The Poulsen arc, then, used direct current, and operated at a slightly lower voltage than the spark transmitters. Being a dc arc, it could not be keyed on and off, because it could not be broken and restruck fast enough. Poulsen answered this by having the key short a portion of the tuning coil, introducing frequency-shift keying. The Poulsen arc produced a nearly continuous wave. With no modulation on the signal, it couldn't be heard with the conventional receivers of that time. This bug was, strangely enough, tackled at the receiver end. A device called a "ticker" opened and closed the circuit to the earphone several times a second so that the dc level resulting from rectification of an unmodulated signal was broken to produce a buzzing sound. Then a man by the name of Reginald Fessenden came onto the scene.

Fessenden began with what was intended to be an improvement to receivers, and ended up revolutionizing the entire field of radio communication. His first idea was to make an undamped radio signal, as a pure continuous wave was called, audible by injecting another signal into the receiver at a frequency a few hundred cycles removed from the incoming signal, thereby producing an audible sound. He called it the "heterodyne." Utilizing the same principle, he then tried injecting the audio signal at the transmitter end. From here the next step was obvious—to inject the human voice in the same way.

In 1900, just five years after Marconi had sent his first CW message, Fessenden succeeded in transmitting the human voice between two fifty foot antennas a mile apart. Ever try to modulate a spark? Probably not, but if you imagine the problems that could you can get some idea of what Fessenden was up against. True, he did transmit a voice, but the buzz on the signal nearly overwhelmed it. Even with a Poulsen arc there was just too much noise on the signal. If Fessenden was to succeed, he needed a device that would produce radio signals which were perfectly clean, so far as noise is concerned, and at a high enough frequency. He had set his sights on 100 kHz.

Fessenden had to wait until 1906 before he could progress any further. Until then, there just wasn't any such thing as a generator of pure rf signals. But in 1906 Dr. Ernst Alexanderson, working for General Electric, developed an alternating current generator with a very high speed rotor and a great many pole pieces. It put out a frequency of 50 kHz. Fessenden had wanted twice that number, but he had been disappointed so many times he was ready to try anything. By December of 1906 he felt it was ready for a demonstration.

The demonstration itself took place on Christmas Eve. Fessenden had passed the word around beforehand through scientific circles, and a few curious but skeptical witnesses gathered in his shack. He began in a fairly innocent manner by sending out a CQ in code. Listeners on land and at sea waited for the code signals they expected to follow. They received an unprecendented jolt. Fessenden picked up the mike and identified himself. Then a gramophone record of Handel's Largo was started up, with the horn pointing into the microphone (The world's first D.J.) After the record was over, Fessenden played a violin solo, and sang, "O Holy Night."

Fessenden himself said he wasn't much of a singer, but no singer before him ever created such a stir. Our generation was deeply inspired on Christmas Eve 1968 by hearing an astronaut read the Bible from the moon, but it was nothing compared to the thrill experienced by the many amateurs and ship's radio operators as they heard this hymn coming out of the ether, which heretofore had carried the harsh raucous buzz of morse code, at this very nostalgic and sacred time of the year. Formality and protocol went down the drain as many a ship's sparks shouted to the captain to come and hear this miraculous voice. One operator, probably a little lonesome for home, entered into the log that he had heard

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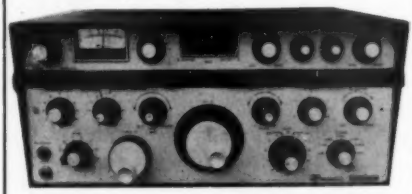

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an angel singing in the ether on Christmas Eve.

The broadcast was a howling success. Letters started pouring in from listeners hundreds of miles away. The learned scientist repeated his broadcast again on New Year's day. So the ice at last had been broken. But there were still many obstacles to overcome. For one thing, there was only so much available frequency spectrum. Fessenden's Alexanderson alternator couldn't go over 50 or so kHz. Before voice transmission could become practical, higher frequencies had to be achieved with a pure continuous wave, and there just wasn't any generator capable of doing it. The world was ready for Lee DeForest.

When Edison stumbled upon thermionic emission in 1893, he simply jotted it down in his notebook and forgot it. His young assistant, Ambrose Fleming, didn't, however and upon discovering its effectiveness in detecting radio signals, patented it in his own name. Fleming was, at the time, working for Marconi, and would not license his valve in this country. American ingenuity was faced with a real challenge. At first the challenge was met by several types of crystal detectors, but then DeForest invented the vacuum tube.

All DeForest knew was that he had produced a better detector. But in 1910, Edwin H. Armstrong, while experimenting with DeForest's "audion," inadvertently completed a feedback loop in the proper phase, and noticed a whistling sound in the earphones as he tuned over a station. Could it be possible that the audion was generating radio signals? It was. Armstrong had discovered it, but somehow DeForest got the patent.

In this sort of thing, however, patents don't mean that much. It is better to say that new circuits were discovered rather than invented. As fast as an experimenter could come up with a new configuration, he would take out a patent. Hartly, Colpitts, it goes on and on. The only really new thing was crystal control of frequency, discovered by Pierce around 1917. Except for that, progress has just been a refinement of what we already had.

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PRACTICAL AMATEUR FM REPEATERS

Amateur FM repeater activity in the United States is growing with leaps and bounds. Most major metropolitan centers now have repeaters operating on 6, 2, and 3/4 meter bands. The most popular frequencies are 146.34 MHz input and 146.94 MHz output or 146.16 MHz input and 146.76 MHz output. Other repeaters operate on the six and 432 MHz bands. Most of these repeaters are maintained by a small, dedicated group of amateurs who act in behalf of a larger group who use the repeater. In other areas there are groups who are interested in establishing a repeater but do not have sufficient information upon which to base their efforts. This is an attempt to fill this void.

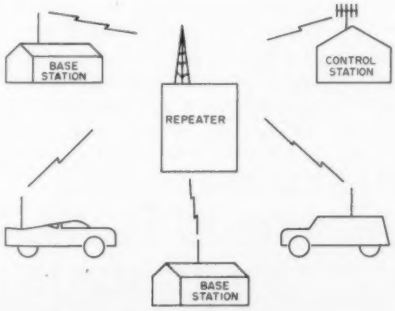

Fig. 1. Repeater operation.

Since each locale will have its own preference as to bands, locations, and available equipment I will deal in broad terms where possible. Specific mentions of equipment will refer only to equipment manufactured by Motorola Communications and Electronics, Inc. This specialization as to references is for two reasons: I am more familiar with Motorola equipment than any other brand; and, because Motorola is now releasing large quantities of equipment to the amateur market in certain areas.[1]

Types of Repeaters

The types of repeaters may be divided and subdivided into several areas: The first division is whether the repeater is an open or closed system. In an open system any carrier on the proper input frequency will key the repeater. This allows access by any amateur to the repeater. In a closed system some type of actuating signal is required to

1. Motorola is releasing to amateurs from the Atlanta, Georgia, Dallas, Texas, offices directly, and in Chicago, Illinois through a subcontractor. Conditions of sale require a photographic copy of the amateur license, a signed statement that the equipment will be used exclusively for amateur operation and not resold for commercial use. Also, only two units of a particular model will be sold to any one individual. Serial numbers are recorded so that if any equipment is returned to commercial service the offending amateur will be known.

operate the repeater when a signal is transmitted on the proper input frequency. This signal usually consists of either a single tone[2] sent at the beginning of each transmission or a low frequency continuous tone transmitted with the input signal (e.g. Motorola's "Private Line" or General Electric's "Channel Guard" systems). In the single tone system a tone decoder actuates a relay which then allows the repeater receiver to operate normally until the signal stops. At this time the system resets and a short single tone is again needed to actuate the system. In the continuous time system a low frequency tone (usually below 200 Hz) is continuously transmitted with the input signal. This tone is decoded by a reed resonant system and the repeater receiver then operates. The former system (single tone) does not require resonant reeds (L-C or R-C networks will suffice) whereas the latter system requires reeds both in the transmitter and receiver which have tolerances of less than 0.5% or better. Since these reeds are comparatively expensive, most amateur closed repeater systems use the single tone system.

Once the decision has been made to operate either a open or closed repeater, the second subdivision of types comes into play. Is the repeater to be of the on-site or of the split-site variety? The on-site system requires that the input receiver and the output transmitter be at the same location. In the split-site system the input receiver is located at some distant point and connected to the output transmitter by either a radio link or a wire line. Each system has its good points.

The split-site system is best when the input and output frequencies are to be close spaced (e.g. 100 Hz low band-6 Meter systems) or when a high power transmitter such as a 250 watt output unit is to be used. The major drawback to this system is that some type of control link must be maintained between the transmitter and receiver sites. This may be either a wire line leased from the telephone company or a radio link on 220 MHz or 440 MHz. The wire lines are expensive, and the radio links must each have a seperate radio control system to comply with FCC regulations. Also, because the transmitter and receiver sites will not have the same geography the radiation patterns will be different. This sometimes results in transmitter "dead spots" where the receiver is hearing and receiver "dead spots" in locations where the repeater transmitter is strong.

The on-site repeater systems place the equipment at one central spot for easier servicing. This is of great help when the system needs repair. When all equipment is at one spot only one team is required to service, maintain, or repair the equipment. Since the location is the same, the antenna radiation patterns will be similar when the same type of antenna is used for both transmitting and receiving. In fact, in sophisticated systems a hybrid-ring type of antenna coupler may be used to allow simultaneous receiving and transmitting on the same transmitting antenna. The drawbacks are that extensive shielding must be used on both the transmitter and receiver (details on this will be covered later) and that tuned cavities must be used in the receiver and transmitter antenna leads (more on cavities later). Also, the noise induced into the receiver will have a degrading effect [2]. This noise is partially overcome by the cavities, but some still remains.

No matter which type of system is chosen, the transmitting power and receiver sensitivity should be balanced so that a properly operating mobile station will be able to talk into the system about as far as it can be heard. This can usually be accomplished by varying the transmitter power level. The perfect system would allow talkback and hear ranges to be exactly equal. Since this is impossible to achieve, it is then desirable : to set the transmitter power a little higher than needed to cover "dead spots" within the normal range of the system.

Choosing the Equipment

The equipment chosen to be used at the repeater site(s) depends upon several things:

2. Wolf, S.M., *FM Schematic Digest*, Two-Way Radio Engineers, Inc., Boston, Mass., pp 91–92.

3. Murphy, J.A., "Receiving System Degradation in FM Repeaters," *Ham Radio*, May 1969, pp. 36–39.

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The band to be used, power level required, physical characteristics of the site, type of control link, etc. Of course in different areas different types of equipment will be available. Whenever possible, choose the newest model which will do the job. This is a matter of common sense, for the older a piece of equipment the more chance for failure. It is often desirable to choose a transmitter with power handling capabilities greater than the system requires. For example, if the system design calls for a 30 watt output transmitter, chose a 50 or 60 watt output unit. This allows the unit to be operated far below the maximum ratings, thus allowing greater tube life and increasing the reliability of the system. If the site is enclosed (building, etc.) a weatherproof enclosure is not needed. A standard rack cabinet, mobile housing, etc. may be satisfactory. If the site is exposed, a weatherproof cabinet or rack must be employed. Most of the major manufacturers of FM equipment use such housings and they are available at reasonable cost on the used market. If possible, choose a site with an existing structure to support the antenna. The site may be a tall building, radio or TV transmitting tower, amateur tower, etc. Only if absolutely necessary should a tower be installed for the repeater. Satisfactory towers are expensive, hard to install, and must be adequately maintained.

FCC regulations require some type of control on each transmitting site. This includes link transmitters in the case of split site repeaters. This control may be maintained by either wire or radio above 220 MHz. Because of this, it is necessary to include equipment for maintining complete control capabilities.

A list of equipment absolutely needed at the repeater site(s) follows:

1. Receiver for input frequency
2. Transmitter for output frequency
3. Antennas for above
4. Receiving cavity (especially at on-site locations)
5. Transmitting cavity
6. AC Power Supplies for all equipment
7. Suitable housing for all equipment
8. Control equipment including:
   A. Tone actuated relays
   B. Wire line coupling equipment or
   C. Radio receiver for control link
9. Squelch relays for each receiver (COR)
10. Timer which may be adjusted for 3 minutes or less
11. ID system either voice or MCW
12. Link transmitter for split-site systems
13. AC power line to handle the load
14. Miscellaneous cables power and rf

Desirable maintainence equipment is as follows:

1. Signal generator with attenuator calibrated in microvolts
2. Wattmeter with known accuracy at the desired frequency
3. Frequency standards[4]
4. Deviation measuring equipment[5]
5. Test set or metering panel if Motorola equipment[6]
6. Complete set of spare transmitter and receiver strips
7. Extra set of crystals
8. VOM or VTVM
9. Small tools
10. Dummy load (usually 50Ω)

Setting Up the Repeater

Once the equipment has been chosen, the next step is to set up the repeater in a convenient location (garage?) for assembly and initial checkout. Each piece of equipment should be individually checked out, retuned for the repeater frequency, and then given an extended "shakedown" run. If the repeater is to be of the on-site type it will be necessary to completely shield the transmitter and receiver strips. Again the major manufacturers can provide a shielding kit for this purpose. However, the same can usually be made at a lower cost by the amateur group. Such a shielding kit normally consists of a "cane" metal enclosure which completely surrounds each unit. All power leads must be bypassed by the use of series chokes and disc capacitors. In cases where the power is brought into the unit through a single power plug an adaptor may be made that goes from the shielding to the chassis

4. Such as TS323, Gertsh FM3, Lampkin 105, etc.
5. Zook, G.E., 'Now You Too Can Have A Deviation Meter," 73, August 1969, pp 96–97.
6. Zook, G.E., 'Add-On FM Test Set," 73, December 1968, pp 18–19.

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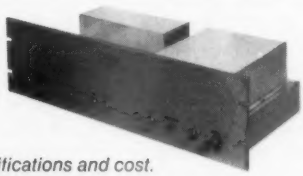

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plug and which includes the needed bypass circuitry.[7]

If the repeater is to be of the on-site variety, cavities will probably be needed for both the receiver and transmitter. These cavities may be bought, scrounged, or constructed.[8] The purpose of these cavities is to isolate the receiver from the transmitter and thus reduce the degrading of receiver sensitivity. In split-site systems cavities may be desirable to reduce interference from other services located at or near the site.

AC power supplies are an obvious necessity. Many supplies built by Motorola, RCA, GE, and others will operate one or more receivers as well as the transmitter. These supplies are highly reliable. However, many older units use tube type rectifiers for the transmitter high voltage. These may be substituted by silicon diode arrays which give better reliability and cooler operation. If commercial supplies are not available, then construct the supplies using the best transformers, capacitors, and solid state circuitry available. The Motorola P8434 (30 watt output transmitters) and P8464 (60 watt transmitters) power supplies are good examples of the commercial units available.

Suitable housings depend, as mentioned before, on the physical characteristics of the site. If the unit is to be housed inside of a building, such as the elevator room of an apartment building, a cabinet rack will provide sufficient room for the transmitter, receiver, control links, etc. If the repeater must be exposed, such as on a tower or building roof, a weatherproof housing must be used. Such housings are commonly used by the major manufacturers. Special housings for pole or tower mounting are also common and may be obtained if the application requires. If a housing must be built, use the best materials available. Remember that ventilation is required, but that ventilation holes must also be weatherproof.

Since FCC regulations require 24 hour control of any remote station it is necessary to provide a control system. This control system may be either by leased wire line or radio control above 220 MHz utilizing directional antennas. In the case of wire line, units are available from the manufacturers for such applications. However, wire lines are expensive. Thus, most amateur repeaters utilize a radio control link. With the "splitting" of the UHF business band (450-470 MHz) many units are becoming available. Of these the Motorola T44AAV (mobile) and L44AAB (base) units are the most common. Since the transmitter and receiver strips are identical in each unit, either may be used as the basis for control links. A scheme for using these units is outlined later in this article.

When radio links are used it is necessary to use some type of information to operate or disable the repeater. Although some repeater groups are now using digital techniques, the easiest method is tone control. Simple tone oscillators such as used in AFSK systems may be used with RTTY type tone decoders at the repeater site. These decoders may be used to operate a stepping relay to shut the repeater down, then back on, etc.

The squelch relay is needed to operate the transmitter when a signal is received by the input receiver. Such a circuit reproduced as Fig. 2. A detailed description of the operation of this circuit may be found on page 92 of the *FM Schematic Digest* published by Two Way Radio Engineers Inc., a *73* advertiser.

A timer is also required by the FCC. This insures that the repeater transmitter will not transmit for a period exceeding three minutes. This prevents tying up the frequency if someone inadvertantly keeps a transmitter operating continuously on the input frequency or if there is failure in any portion

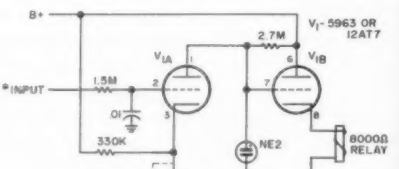

Fig. 2. Schematic of Motorola TK297 squelch relay (COR).

7. *Radio Amateurs VHF Manual*, Eleventh Edition, pp 298–299.

8. *Radio Amateurs VHF Manual*, Eleventh Edition, pp 299–302, or Jessop, G.R., *VHF-UHF Manual* (RSGB), pp 4.1–4.3.

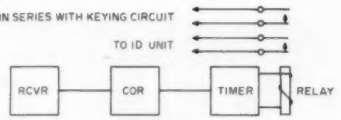

Fig. 3. Timer logic.

of the repeater system. Such a timer may be of either the electronic or electro-mechanical type. The electro-mechanical type is cheaper in most cases. The timer is actuated by the squelch relay whenever a signal is received. If the received signal stops before the time limit is up, the timer resets and begins operation anew when another signal is received. When the signal is in excess of the allotted time, the timer shuts down the repeater transmitter. When the signal stops, the timer resets, and the repeater transmitter may again operate. A working hookup for the timer appears as Fig. 3.

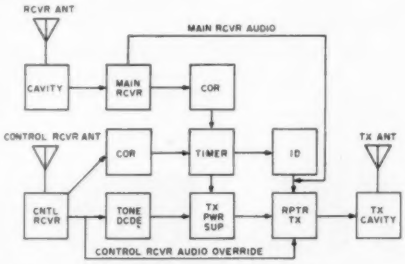

Fig. 4. On-site repeater operation.

Each repeater licensed by the FCC also must have its own call sign. This call sign must be transmitted in accordance with FCC regulations. Two methods are suitable for repeater ID: Voice ID and MCW ID. The voice ID may be accomplished by using a closed loop on a tape recorder playback head. The actual words used can vary, but many repeaters have the call sign and location. The MCW method can use either an electromechanical arrangemen such as a code wheel or an electronic method[9]. In either case the ID is usually as follows: "QRA DE WA5XXX."

9. Connors, John, "A Programmable Repeater Identifier," *Ham Radio*, April 1969, pp 18–23.

The repeater System

The repeater system components and their relationship to each other are described in Figs. 4 and 5. Fig. 4 is the on-site repeater diagram and Fig. 5 is the split-site repeater diagram.

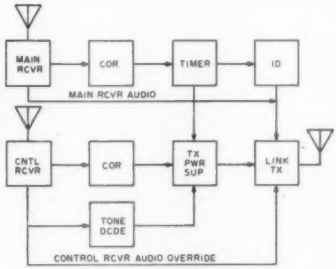

Fig. 5A. Split-site receiver.

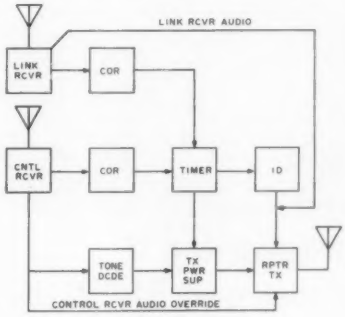

Fig. 5B. Split-site transmitter.

Control Stations

The block diagram of a control station appears as Fig. 6. This station (or a number of these stations) must be manned 24 hours per day if the repeater is in constant readiness. If the control station is not manned for any length of time, FCC rules

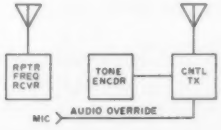

Fig. 6. Control station.

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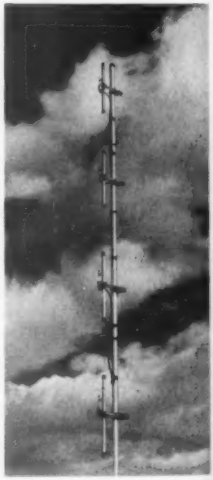

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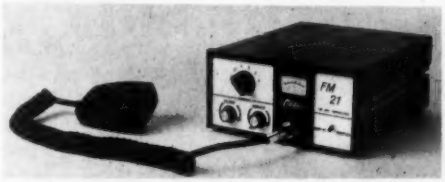

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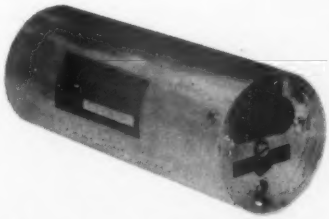

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require that the repeater be made inoperative until the control station is remanned. Such a control station should consist of a transmitter capable of operating on the control link frequency, a tone encoder for operation of the control circuitry, a directional antenna[10] (also required by law), and a receiver capable of receiving the repeater transmitter. The logic at the repeater site should be wired to allow the control transmitter to override any incoming signal (see Fig. 7).

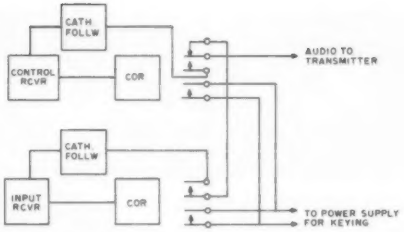

Fig. 7. Relay logic for audio override.

Logging Station

The FCC also requires that accurate logs of the repeater operation be kept. A simple method of achieving this is to use a receiver on the repeater transmitter output frequency with a COR operating a tape recorder. If a dual channel recorder and a second receiver tuned to WWV or CHU are used, a time hack will appear along with the information transmitted through the repeater. The tape can be changed and retained for one year and then reused. A block diagram of this appears as Fig. 8.

Antennas

The antennas used in the repeater system should be omnidirectional. Everyone has his own ideas as to what type is best, so I will not try to recommend any one particular type. If the on-site system is used, keep the receiving antenna as far away from the transmitting antenna as possible. This will reduce the receiver desensing by the transmitter. The radio link and control link antenna(s) should be directional. Small beams[11] or modified UHF TV corner reflector make excellent link antennas (especially when fed with low-loss foam twin lead).

Audio Coupling

Commercial FM repeater systmes often use a wire line termination chassis for coupling the audio from the input receiver to the output transmitter. This system is fine if the chassis is available. Since this is not usually the case, a simpler and less expensive method must be used. The simplest and most effective method is to connect a cathode follower circuit to the audio output of the discriminator. The output of the cathode follower is then fed into the microphone input of the repeater transmitter (or link transmitter in the case of split-site repeaters). This system allows the deviation of the output transmitter to be independently controlled by the deviation control in the transmitter, and not by the audio gain control in the receiver. This way the audio section of the receiver may be used for monitoring whenever a maintenance team is at the repeater site. If the audio is taken from the receiver audio output stages and then coupled to the transmitter, any resetting of the audio gain control will require recalibration of the transmitter deviation. Usually the audio required for sufficient deviation results in a very low audio output from the receiver. Thus, when a service team turns up the audio to hear incoming signals, the deviation from the transmitter increases. Thus, it is desirable to isolate the audio going into the transmitter from the audio going to the speaker. This is why the cathode follower circuit. See Fig. 9 for a working unit.

Audio Override Circuitry

It is very desirable to allow the control station audio override. This enables the

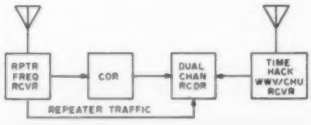

Fig. 8. Block diagram.

10. Zook, G.E., "Curtain Rods, Coat Hangers, and Control Links," 73, June 1969.
11. Ibid

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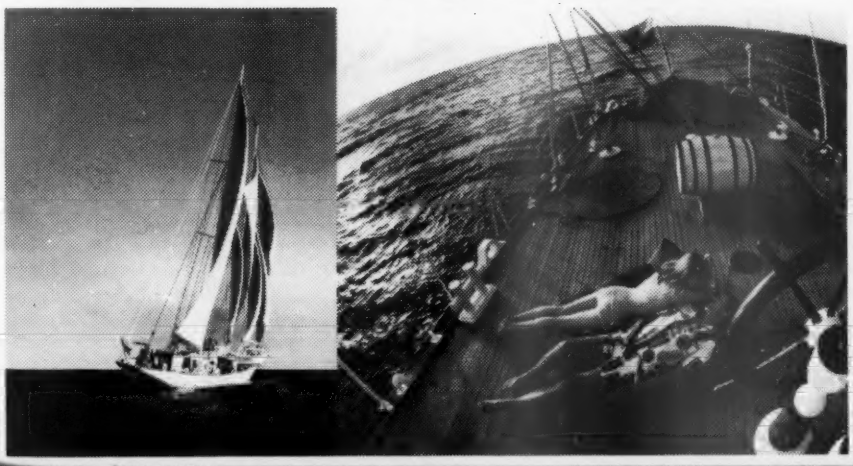

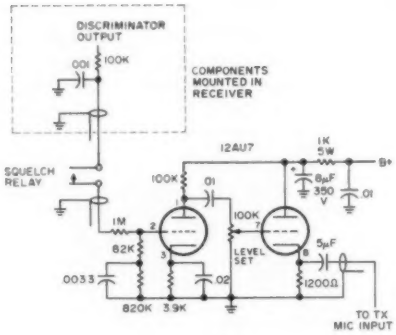

Fig. 9. Cathode follower.

control station to break in over any station on the regular input frequency. This may be accomplished with simple relay logic which appears as Fig. 7.

Tone Control Units

A tone control unit for turning the repeater off and on is a legal necessity. The basic circuit can be the same as a RTTY tuning unit. The only difference is that the tone is continuous rather than shifting. To avoid unauthorized control, the control tone may consist actually of two tones. The only requirement is that they not be harmonics of each other or have a beat note that is a harmonic or sub harmonic of either tone. The relay logic may then be worked so that both tones must be present for the control system to work. A diagram of the logic appears as Fig. 10.

Single Tone Units for Restricted (or Closed) Systems

Single tone units for closed systems are only slightly harder to build than normal audio circuits. The requirements are that the tone be short and on the correct frequency. The schematic of the tube type Motorola encoder (transmitter unit) and decoder (receiver unit) appear as Fig. 11 and 12. These circuits may be easily duplicated and the tone frequencies varied to fit local requirements.

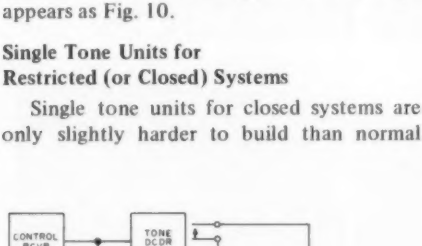

Fig. 10. Relay logic for two tone control.

Single Tone Units for Restricted (or Closed) Systems

Single tone units for closed systems are only slightly harder to build than normal audio circuits. The requirements are that the tone be short and on the correct frequency. The schematic of the tube type Motorola encoder (transmitter unit) and decoder (receiver unit) appear as Fig. 11 and 12. These circuits may be easily duplicated and the tone frequencies varied to fit local requirements.

Deviation

Although amateur FM activity has been generally of the wideband (±15 kHz) variety the trend is toward narrowband (±5 kHz). This is because of two things: The equipment now being released is of the narrowband variety and the population on the VHF bands is increasing by leaps and bounds thus requiring more and more channels. Wideband receivers will receive narrowband signals with a loss in audio gain. This may be overcome by the addition of audio recovery circuitry. Such circuitry usually consists of only two or three resistors. The other narrowbanding circuitry consists of sharper high and low i-f stages. These are not normally required in amateur operation. When a narrowband receiver is used in a

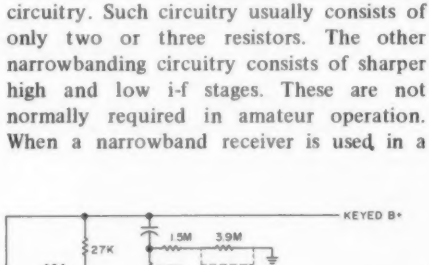

Fig. 11. Motorola single tone encoder.

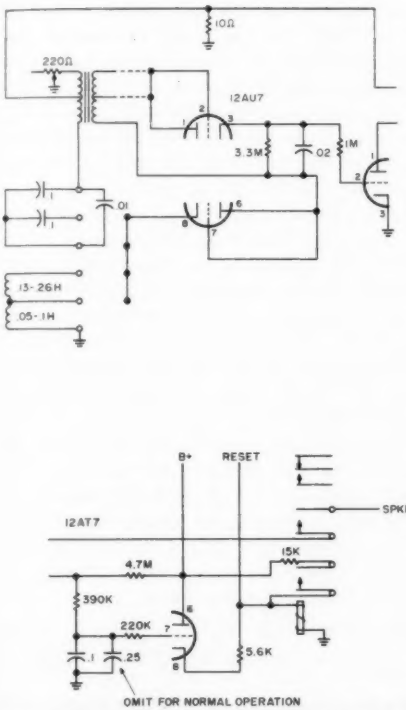

Fig. 12. Motorola single tone decoder. See p.p. 91–92 in FM Schematics Digest for frequency and operation information.

wideband system, the signals will "chop out" unless the squelch is turned off. If the units in a particular area are divided between narrow and wideband units it is possible to use ±7.5 kHz deviation. This is sometimes called "belly-band." Such deviation will not chop out on narrowband receivers and will produce sufficient audio on wideband receivers.

The repeater system should be adjusted so that whatever deviation comes into the system goes out at the same level up to the point at which the transmitter clipping circuit takes over. This requires a little patience in adjustment, but it is necessary especially when the units using the repeater also work direct on other frequencies.

Location

The location(s) for the repeater must be carefully chosen. Just because a location is

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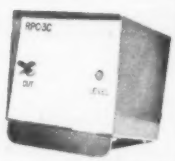

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high it may not be the most desired. Often high buildings are built in lower areas. Radio and television transmitting towers are often built on the highest points around but may be located some distance from the desired coverage of the repeater. Also, the noise level at some sites may be much higher than at others. Close proximity of heavy traffic may affect six meter receivers but have much less effect on two meter equipmen. Other transmitters in the business or public safety services may cause intermod which may be greater at one location than at others. Thus, it becomes necessary to check the site out before the repeater is installed. This checkout should be made in several trips to the site at different times of the day and on different days of the week. The noise level on Sunday afternoon will probably be much lower than on a Monday afternoon when everything is in full swing. At night, neon signs and similar electrostatic systems may produce interference which adds to the total noise figure.

The desired location should have the following characteristics: high in relation to the area to be covered; centrally located within the desired area; convenient for access to the equipment for service; have an enclosed weatherproof place for the equipment; have sufficient power capabilities; low or no charge for use. Of course not all criteria can be met in all cases. It may be necessary to sacrifice an enclosed mounting area for a lower noise level. Or, in the case of a centrally located TV transmitting tower ease in access may be sacrificed for the height gained. In all cases a little common sense will save many headaches. For instance, don't put a six meter repeater on a channel two tower! The lower sideband of the TV signal though attenuated will completely block the six meter receiver.

If a location is found that meets all criteria except permission for use, it is often only necessary to approach the local Civil Defense or Red Cross office. Often these organizations will lend their influence to obtain permission to use a site (often at no charge, even for electricity!).

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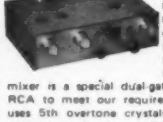
2 RF stages with transient protected dual-gate MOSFETS give this converter the high gain and low noise you need for receiving very weak signals. The mixer stage is also a dual-gate MOSFET as it greatly reduces spurious mixing products – some by as much as 100 dB over that obtained with bipolar mixers. A bipolar oscillator using 3rd or 5th overtone plug-in crystals is followed by a harmonic bandpass filter, and where necessary an additional amplifier is used to assure the correct amount of drive to the mixer. Available in your choice of input frequencies from 5–350 MHz and with any output you choose within this range. The usable bandwidth is approx. 3% of the input frequency with a maximum of 4 MHz. Wider bandwidths are available on special order. Although any frequency combination is possible (including converting up) best results are obtained if you choose an output frequency not more than 1/3 or less than 1/20 of the input frequency. Enclosed in a 4-3/8" × 3" × 1-1/4" aluminum case with BNC receptacles, power and antenna transfer switch. Thousands of our converters are now in use by satisfied customers, many of whom are government agencies and universities.

Model 407 price: 5–200 MHz $42.95
201–350 MHz $44.95

Prices include .005% crystal. Additional crystals $5.95 ea.

UHF 20 dB MIN. GAIN 3 to 5 dB MAX. N.F.



This model is similar in appearance to our Model 407 but uses 2 low noise J-FETS in our specially designed RF stage which is tuned with high-Q miniature trimmers. The mixer is a special dual-gate MOSFET made by RCA to meet our requirements. The oscillator uses 5th overtone crystals to reduce spurious responses and make possible fewer multipliers in the oscillator chain which uses 1200 MHz bipolars for maximum efficiency. Available with your choice of input frequencies from 300–475 MHz and output frequencies from 14–220 MHz. Usable bandwidth is about 1% of the input frequency but can be easily retuned to cover more. This model is now in use in many sophisticated applications such as a component of a communications link for rocket launchings.

Model 408 price: $51.95
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Model FMR-250-11 price: 135–180 MHz $109.95
181–250 MHz $119.95

Price includes one .001% crystal. Additional crystals $6.95 ea.

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All the preamps on this page are available only from Vanguard Labs. For receivers and converters, state model, input and output frequencies and bandwidth where applicable. Remit in full, including sales tax if you reside in New York State, direct to Vanguard Labs. Prices include postage by regular parcel post. For air mail or special delivery include extra amount; excess will be refunded. Send money order or certified check for faster shipment.

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repeater. Each system requires something that another system may not. However, I will outline two systems (one for six and one for two meters) which I prefer. These systems use Motorola equipment exclusively. This is not to say that equipment manufactured by other companies is not entirely satisfactory. The reason that I have selected Motorola is familiarity, based on having worked with the equipment during employment with Motorola Communications & Electronics,that portion of Motorola which manufactures and sells the FM equipment. In fact the repeaters in the Dallas-Fort Worth, Texas, area utilize from a complete Motorola system to a hybrid of General Electric and Motorola with a little RCA thrown in for good measure. Each one of these repeaters operates very well.

My choice for a six meter repeater is as follows: A split-site with input and output frequencies separated by 100 kHz. The receiver site would utilize a "J-Pole" antenna feeding a Motorola "G" receiver. The audio output would be fed from the discriminator through a cathode follower to a 18 watt output (cut back to 10 watts) 450 MHz Motorola "A" transmitter operating on or about 449 MHz. This link transmitter would feed a small yagi antenna aimed towards the transmitter site. The squelch relay would be of the tube type described earlier. The timer would be electro-mechanical for good reliability. The control receiver would be a Motorola "A" 450 MHz receiver operating around 445 MHz feeding a two tone decoder. The tone decoder would operate the latching relay to enable the receiver link transmitter to be turned off and on by the control station. The control station would have audio override capabilities. The transmitter site would utilize a Motorola "K" or "J" transmitter (60W and 100W output respectively) cut back to around 50 watts. The receiver from the link would be a Motorola 450 MHz "A." The audio would be fed from the discriminator through a cathode follower to the transmitter. The squelch relay would be the same tube type as mentioned before. Proper identification with the repeater call sign would be accomplished by a code wheel keyed by the timer. The timer would again be electromechanical. The control receiver would be another Motorola 450 MHz "A" operating on a frequency 100 kHz above the control receiver at the receiver site (this is to allow a single control station with a two frequency transmitter to control both sites). The tones utilized would be different to avoid possible accidents. The tone decoder would be the same design as at the receiver site. The transmitting antenna would be another "J-pole."

The control station and logging station would be at the same location. The control station would consist of equipment capable of operating on the repeater input and output frequencies such as a Motorola L41GGB. The 445 MHz control transmitter would be either a 450 MHz "A" or, if obtainable an L44BBB consolette base station. The encoder would consist of four oscillators using telephone type toroids as the frequency determining circuit. The control link antenna would be a small yagi.

The logging station would consist of a receiver operating on the repeater output frequency feeding a stereo tape recorder recording at the lowest speed possible. The tape recorder is turned off and on by a squelch relay. The audio would be taken from the receiver through a cathode follower and fed into one channel. A command receiver would be tuned to either CHU or WWV (whichever gave the best 24 hour signal in the area) and its output fed through a cathode follower to the second channel.

My two meter repeater would be of the on-site variety. The antennas for both transmitting and receiving would be of the fiberglass "croppie pole" variety. The receiver would be a high band Motorola Sensicon "A" (this receiver has a front-end which incorporates either five or six cavities depending on the exact model). If needed, a cavity would be placed in the receiver antenna line. The transmitter would be either a Motorola "A" or "K" (both 60 watt output rating, differing only in that the "A" utilizes an 829B final whereas the "K" uses a 5894) cut back to 50 watts output. A cavity would be put in the transmitter antenna lead. The timer and audio circuitry would be the same as in the six meter units, as would be the control link. In all cases the power

supplies would be Motorola P8464 units. Also, both repeaters would be open to all amateurs.

As stated previously, units manufactured by companies other than Motorola will do an excellent job. The General Electric Progress Line units are used quite extensively as are RCA 450 MHz units. The prime concern is whether or not the units used meet the requirements of the particular system. In some systems very low power in the order of only two or three watts will do the job. In other systems a "quarter KW" (250 watt output) transmitter may be needed

Why the Repeater?

This article has progressed under the assumption that the decision to establish an amateur FM repeater has already been made. For the benefit of any hardy soul who has read this far and who has not made up his mind or who requires a little more knowledge as to repeater operation I have listed below some of the pros and cons of repeater operation.

An amateur FM repeater serves to greatly increase the usefulness of mobile units by increasing their effective range. A low power mobile signal is received by the repeater at a distant, but favorable spot and then retransmitted at a higher power level from a transmitter also located at a more favorable spot. The same can be said for portable and hand-held equipment. Using repeaters it is often possible for two one watt hand-held units to talk over ranges (including to each other) which high power base stations may have trouble communicating. The range of base stations is increased, especially when talking to mobile units which may be in poor locations regarding the base station. During band openings (and these DO occur) the repeater will hear and be heard by distant stations long before most base stations can be heard. For example during the Spring of 1969 the Tyler (Texas) repeater and the Tulsa (Okla) repeaters were hearing and being heard by FM amateurs over a great portion of the Eastern USA. The St. Louis repeater was heard in the Dallas – Fort Worth area, thus allowing two meter FM operators to work each other over large portions of the country.

Along with the good of amateur FM repeaters there also must be the bad. Some amateurs tend to use the repeater as a crutch. That is, they keep their equipment and antenna systems working only well enough to use the repeater. When the repeater is off for repairs or when operation on another frequency is desired, these stations are marginal if operative at all. Also, if a new location is tried for the repeater, amateurs who formerly were near the repeater and who have not maintained their equipment will suddenly become very unhappy because they cannot use the repeater without working on their equipment. Another problem is that two stations using the repeater can tie up the frequency for others within the range of the repeater. This can be solved by several methods, including use of alternate frequencies once contact has been established and of allowing short pauses for other stations to break in. Some repeater organizations limit the time which the repeater may be used for a single QSO. This, however, is distasteful to many amateurs. Thus, a little courtesy will do wonders for the usefulness of the repeater system. A third possible problem occurs when ac power is lost during an emergency situation. Since the repeater is very useful during emergencies, it should be provided with an auxillary power source independent of the usual ac lines (such as an automatic starting generator). Also, many mobile and portable units have only repeater frequency capabilities. This should be overcome by the incorporation of direct transmitting capabilities as well as repeater input.

Conclusion

All circuits included in this article are presently in use in either amateur or commercial FM repeaters. Since each repeater will have a slightly different requirement from any other an exact model is not practical. However, by using the circuits in this article along with the equipment locally available it should be possible to build an effective repeater for local amateur FM activity.

. . .K9STH

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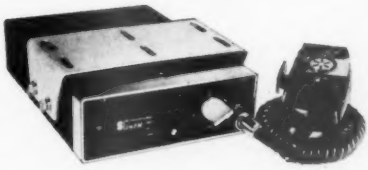

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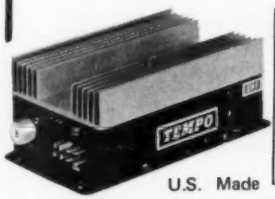

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502	5-15 watts	35-55 watts	$105
502B	1-2.5 watts	45-50 watts	$130
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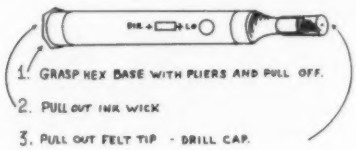
TEST PROBES need not be costly!

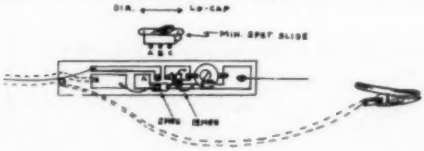
The proper test probe for your vtvm, FET, vom, or scope won't cost the usual $12–$19 if you are willing to spend an hour, a few cents, and follow the procedure below.

The usual stumbling block in home brew probes is not the circuitry but obtaining a suitable housing or probe body. The common *"Carters Marks-A-Lot"* felt tip pen appears to be the answer. These felt tip pens have an aluminum housing which is convenient to hold, is large enough to house the necessary components and, when the paper label is removed, has a professional appearance when assembled. Obtain an old pen (new will also work, if you must), and disassemble as shown in Fig. 1. Any of the



probes listed below may be assembled as the example in Fig. 2 (low capacity scope probe). The direct, low capacity switch – spst – may be incorporated or eliminated from any of the circuits shown.

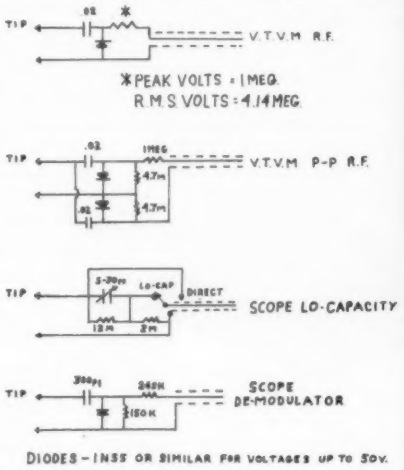
Component mounting may be on a small single side etched board, or copper clad is easily cut with a hobby knife where straight line patterns are required. Vectorboard or thin plastic material may also be used. If plastic is used merely heat a small piece of wire and melt the component mounting holes where needed. The probe tip may be a piece of stiff tinned wire or a pin type connector. The use of the pin connector allows easy connection of clips, etc.



Caution: These felt pens are available with both metal and plastic caps. Should your pen have the metal cap it should be discarded. The tip may be isolated from the body by slipping a small piece of the inner insulation from a piece of RG58 type cable over the tip and sliding it down into the probe body. The ground lead is a 6 to 8 in. piece of shield from RG58 cable. Be certain the ground lead is secured to the probe housing as well as the circuitry and solder a clip to the free end.

The circuits shown below are designed for vtvm or vom with an 11 MΩ/V impedance. The scope probes are designed for scopes with 1 MΩ input.

In the following circuits, the dc blocking capacitors are 600V rated. The 1N55 diode has a piv rating of 150V and will safely handle 50V of rf. Once the assembled circuit



with connecting cable has been inserted into the probe body, push a small plastic cap, which has been drilled, over the cable, and on to the open end of the probe. Be sure the cable shield is grounded to the circuit ground as well as the probe body. A small amount of R.T.V. (rubber seal) inside the plastic cap will act as a strain relief.

. . .WB4MYL

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Finding parts for an ac supply can be easy if you have in mind the "how to do it."

Here is a simple and quick way to lash together a supply that I found in the old junkbox.

T1 can be any heavy duty transformer (an old TV transformer is ideal as it usually has a high filament rating).

I built mine on a 19 x 5 in. rack panel, but a chassis box works well and can be installed in the mobile case.

Don't forget the caps across the relay contacts as they are very important. Their function is to prevent arcing of the relay contacts.

. . .K6VBT

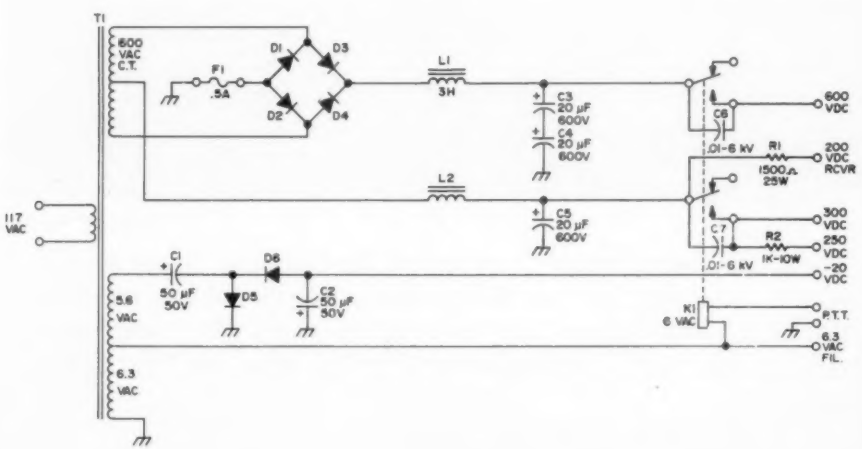

Fig. 1. Base supply. T1 – Merit P3059 or equivalent; Sec. #1 – 550–600V CT; Sec. #2 – 6.3V ac @ 3–5A; Sec. #3 – 5.6V ac @ 2–3A; D1-4 – 1000V diodes @ 1A; RL1 – DPDT relay 6.3V ac coil.

Zero-Beating with the Frequency Meter

After putting an LM-18 in service, I found it a nuisance to plug in headphones every time it was necessary to adjust the corrector control to produce Zero Beat at one of the crystal check points. I hooked up a phone plug to the plate winding of an audio output transformer, and then connected a small loudspeaker to the secondary winding. I leave the phone plug inserted in the LM phone jack at all times. After using this setup for a while, it occurred to me that the last few cycles either side of zero beat might not be audible, so I tried a parallel hook-up off the primary side of the transformer. The other end of the cable was connected to the Vertical input of an oscilloscope. Now, when adjusting the corrector control for zero beat, you will see low amplitude sine waves even after you can no longer hear the beat note. You tune out the sine waves until you have a perfectly straight reference line on the scope. The Heterodyne oscillator is then corrected to calibration much more accurately than trusting to the ear alone. The principle is not new, yet the idea may not have occurred to some people. Any old scope will do, as the frequencies are in the audio range.

Another bit of frustration occurred when trying to adjust the corrector knob. I would pass the zero beat point time and time again, due to the stiffness of the control. Remember, these units are built for ship-board use, and loose controls cannot be tolerated. I dug up a small vernier tuning drive, similar to the Jackson Planetary-Vernier drive, (about 5 to 1 ratio). I mounted this drive on a right-angle aluminum bracket and attached it to the LM using the two screws on the upper right side of the unit. Bore holes slightly oversize to allow for accurate alignment of the control shaft so that it will not bind. Cut out a portion of the bracket so the "High-Low" knob can be moved. The precise Zero beat adjustment can now be made very easily with the reduction drive.

Jim Harrison, Jr., WB4TBX

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There are many applications in which random selection switching is better than the sequential action obtained by using a rotary switch. For example, in television it is advantageous to be able to change quickly from one camera to another without having to go through a fixed pattern of selection. The interlocking push-button switches on the market today fill the needs of many applications; however, they do have a number of disadvantages. If one section of the switch goes bad, usually the whole assembly must be replaced, which is both time consuming and expensive. In some applications it is necessary to provide the same switching functions from more than one location, which means that some sort of a release device must be provided at unused positions. This is usually a solenoid that operates the release mechanism on the button assembly. This involves expense and space that might be better used elsewhere. What would seem to be most desirable is a system that would use relays to provide switching of the controlled circuitry, and would use individual push-buttons (illuminated or non-illuminated) of the single pole type to control the relays.

With this in mind, a circuit was developed which allows the following:

1. Use of any normally open momentary action switch.
2. Use of low voltage dc relays.
3. Use of as many circuits as are necessary, operated from one or more locations.
4. Easy expansion of the system.

The circuit is actually a variation of the self-holding type (Fig. 1) which is probably familiar to many. Once the "on" push-button is activated, the relay operates and its own "make" contacts then mantain the path first established. In order to release the relay, a normally closed switch must be momentarily operated, which breaks the path to the relay coil and allows it to return to its unenergized condition.

In the revised circuit (Fig. 2) the operate button (OP. . .) is momentarily depressed and the first relay to operate is RL. This is

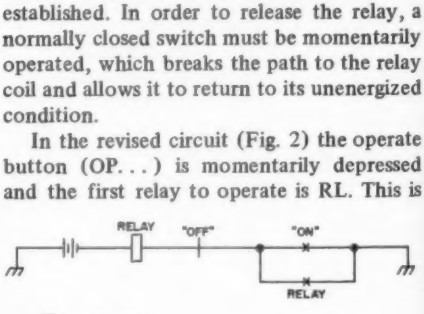

Fig. 1

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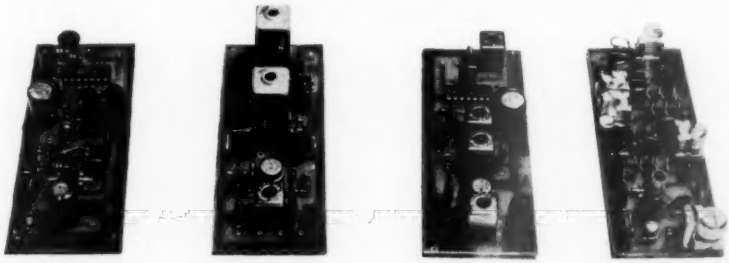

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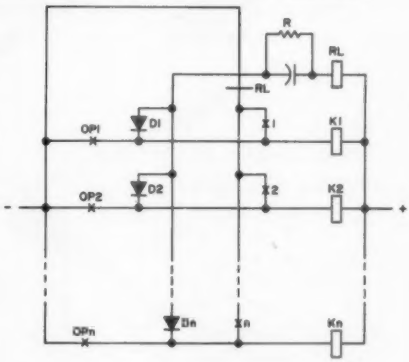
the release relay, which comes up briefly until the capacitor C is charged; and current flow through RL ceases, allowing RL to return to its normal (released) condition. Resistor R across C provides a discharge path for the capacitor and should be small enough to let C discharge rapidly, but not so low as to hold RL operated. It can be seen that a normally closed contact on RL is in the hold path for all the other relays in the circuit. When RL operates, it opens the holding path for any other relay in the circuit, allowing it to release. This also stops the possibility of the newly selected K . . . relay from latching until RL releases. By choosing the operate and release times of RL and the K relays, make-before-break and break-before-make operation can be achieved.



The C capacitor must be empirically chosen for the particular relay used for RL. This relay must operate and release quickly, allowing only sufficient time for any operated K relay to release. Proper operation of this circuit is a matter of timing. Relay RL operates and releases as well as a K relay operating all in the short time interval that the OP . . . switch was held operated. If illuminated push-button switches are used for OP . . . , the lamps for these can be connected across its associated K . . . relay. These lamps and OP . . . switches can be wired in parallel so that operation can be effected from more than one possible location.

. . .W9SEK

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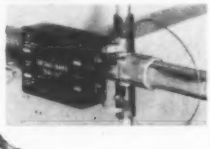

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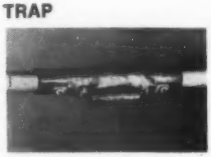

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AN ANTENNA and DIODE RECEIVER for 432 MHz

This discussion concentrates on one example of an antenna and one example of a diode receiver for 432 MHz. These units should serve to take you well up into the fascinating field of low-cost solid state microwaves which is just beginning to open up.

In transistors we now have the $1.50 plastics which operate on 1296 MHz, stemming as usual from the mass market of radio and TV, and who knows, if TV gets into microwaves perhaps we'll get microwave transistors for a buck.

Actually the process is already beginning, with the auto radio industry leading off with radar brakes, highway guidance and the like, up around X band. Detroit is talking (as usual) not in hundreds of systems but millions of systems. This may well bring us the X-band diode oscillators for under $10. They already can be bought for less than $20.

Interested? Let's plunge into the deal. You only have to add another oscillator and a broadband i-f strip to turn the diode receiver into mixer and make up a superhet receiver. For only $6 you can modulate the transmitter and who knows how far you can

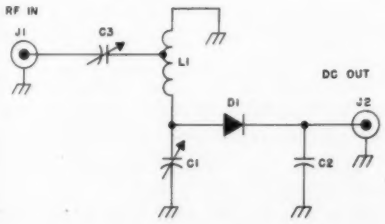

Fig. 1A. Schematic of diode receiver for 432 MHz.

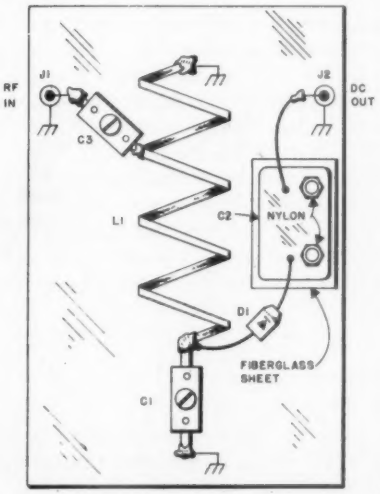

Fig. 1B. Lifesize drawing of the 432 MHz diode receiver layout.

QSO from mountain tops. The whole rig needs only a 98¢ lantern battery for power. *Use* your license and have more fun! I guarantee you no QRM, except perhaps when the band opens up.

Diode Receiver for 432 MHz

In order to check out the antennas you will have to have a receiver, and the design shown in Fig. 1 is just about as simplified as you can get and still tune well and be very sensitive. It works!

Using a parametric microwave diode it puts out 5V dc on J2 from a 432 MHz oscillator coupled to it with some 5 ft of RG-58 cable. This is using inexpensive RCA-type phono jacks for rf connectors by the way.

C1 peaked up immediately as soon as the oscillator was turned on. This type of receiver works well right up to 2500 MHz, although you should use a half wave line instead of a quarter wave at that frequency.

It seems almost funny to use a coil and shunt capacitor for tuning at 432 MHz, but ever since I tried it I find that it's hard to beat and certainly is handy.

You might say no precautions are needed for this one, and you'd be nearly right. C2 is a brass capacitor to ground, about 1 in. square. C1 and C3 are ceramic trimmers, or mica compression trimmers, about 1–8 pF.

Every little four or five turn coil I've wound so far has worked on this band. Start the rf input tap of L1 at one turn from ground, and maximize later. I'll admit the diode is a super-duper. It's a Schottky-barrier type, made by Parametric Industries of Winchester, Mass., costs nearly $3 and is worth every penny of it. It's good up to X-band, and is a good mixer also as soon as you want to convert this diode job into a superhet.

Standard Test Antenna for 432 MHz

This can also be quite a subject by itself so we'll just hit the essentials and show one good example of a working model.

On these frequencies you have the antenna right on your bench where you can put your fingers on it, tune it, add or subtract

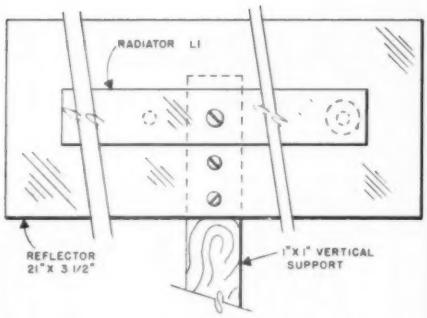

Fig. 2A. Front view of the test antenna 432 MHz.

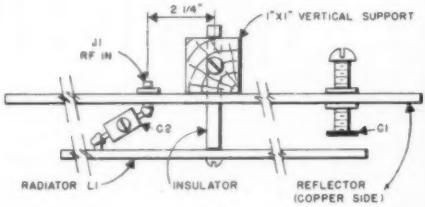

Fig. 2B. Top view of the test antenna for 432 MHz.

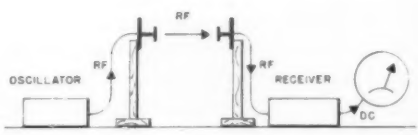

Fig. 2C. 432 MHz test setup and antenna tuneup.

lengths, change spacings, check for high and low rf voltage to be sure you do have a half wave, find the 50Ω points (there are two of them), vary the Q, change the directivity, measure the frequency of your oscillators, and find the antenna gain. All this without either a power meter or a frequency meter. I just don't happen to have either of those myself.

Lads working for large companies get their pictures taken checking little pieces of equipment surrounded by masses of expensive-looking test sets, meters, and scopes, mostly bought by Uncle Sam.

We're not making omnidirectional antennas, so let's start with a reflector of copper clad, large enough so it doesn't resonate, put

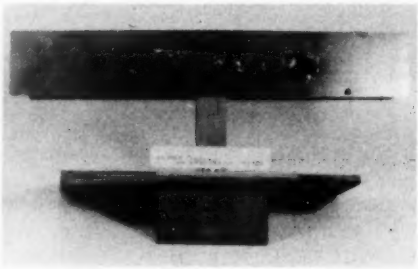

Photo of test antenna. Six inch ruler shows scale.

There is of course the physical need of moving C2 when you change the spacing of the radiator L1. I sometimes use a mica trimmer with a slightly S-shaped soft copper strap in order to be able to vary the spacing of L1 without changing C2. When an approximation is reached, and you get the feel of it, you can put in a permanent connection.

The value of C2 of course depends on the other parameters also. This is quite the usual order of things in R&D, where a number of variables have to be shifted around. For the experimenter the best way is by a series of a half wave radiator out in front, and see what happens. Make it a little short so you can tune it, and mount it at the center on an insulated push rod so as not to affect the voltage distribution, and install C1, a "penny tuner" near one end, as in Figs. 2A and 2B.

Bring your 50Ω rf input cable into the picture through the reflector on J1. This is an experimental antenna so you could make several holes for J1 in order to find the best match along the radiator. Either side starting from the radiator center will do.

C2 cancels the inductive reactance that starts building up the moment you uncover the center conductor of your feed cable to connect it to something. If you look carefully at this antenna and imagine it to be 270 ft long and suspended high over the field near your shack, you will see a certain resemblance to a Windham antenna. Just a resemblance, mainly in the one wire feed. When I have passed on to that Happy DX Mountain in the Sky, maybe this one will be called "The Old Hoisington Antenna."

The radiator is now ready to go to work for you. Bring the 432 MHz energy in on K1, put another standard antenna a few feet out in front and facing it, attached to the diode receiver, and watch that meter.

Tuning

For the radiator length you can start with some 10% less than a half wave in space which should give you nice tuning on C1. Generally you should use as small a capacity as possible for C1, just enough to peak the radiator. Be sure it *does* peak, that is, go through resonance with a maximum which then falls off on each side. Watch your receiver meter to see that this does occur.

Spacing

This is a trade-off like so many things in life, as well as in science. At ¼ wavelength spacing you will get the lowest Q, with very broad tuning. At very close spacings you can get a high enough Q to make an oscillator or an amplifier out of the radiator, but that's another whole story.

It won't take you long to find the spacing you need with the system test setup of Fig. 2C.

Finding the position of C2 along the radiator, L1 is next. When you start to work with this parameter you will see its interaction with some of the others such as its value in pF, which will be low, radiator length, spacing, C1 tuning, width of the radiator, and possibly more.

Table I. Antenna Test, 432 MHz

Reflector Size	Radiator Length	C2 in pF	Distance C2 to Center of L1	D, Spacing Radiator to Reflector	Remarks, Tuning of C1. Also the Bandwidth
			D, Radiator spacing from reflector		
21" long, 3½ wide	11¼	Open.	2 1/8	7/8	Sharp
		Less than 2			
		2 to 3 pF		1½	Medium
		7 to 8 pF		2"	Broad

approximations. You set up one item, vary the others, set another value in, change some more, and after some time goes by, and if you're lucky, you begin to see the best range of values for each parameter. You're getting close then. Pretty soon, if your luck holds, although it may take hours or days, as with my 36 ft wide-spaced two meter yagi where it took weeks, you will reach the point where anything you do *drops* the gain of the antenna you are tuning up. Then you're real close. In fact you could very well stop there and check the gain relative to a dipole by the distance method, and you should then have a good test antenna.

Just to show you what you can learn about a radiator and sheet reflector in a short time, here is one test run that was performed on the antenna of Fig. 2A. The equipment test setup is shown in Fig. 2C. Two antennas as in Fig. 2A were used, and the changes made on one of them. Table I shows the result. A lot can be learned from just that one run using three settings for the spacing of the radiator from the sheet reflector.

1. With close spacing it doesn't take many pF to couple to the radiator. The radiator is "hot" and sharp in tuning and a small amount of coupling pF will cause a large reaction (energy feed).
2. As you go toward the ¼ wave spacing, the Q drops, and the radiation increases. Witness the increase in power at the receiver.
3. As you go *past* the maximum radiation point the Q is going down and the radiation drops also due to less rf on the antenna, and the antenna is also more broadband. This latter may be desirable from the point of view of the vfo lad chasing all over the band (this does not necessarily apply to the 432 band as yet!) but he just won't have the gain of the chap who peaks up and stays near that frequency.

Notice that several other parameters were not varied in this test run. After all, I said it was a short run.

If this gives you some ideas to try yourself, that's why I wrote it.

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W2NSD *(continued from page 2)*

er? The Standard 146 comes with 34–94 permanently wired into place. So why make this a useless combination in all of the major cities?

Is it possible for repeater groups in each major city to get together and put up a 34–94 machine which will enable visitors using one watt units to have some fun and meet local amateurs? It needn't be a gigantic alligator, just something so that when someone comes to New York he will be able to talk a little. No other channel has the possibility of being, quite simply, a universal calling channel and meeting place for travelers.

If there is any mass movement to 52 for a simplex channel you can bet that crystal prices will drop even lower than they are at present. A 52 pair now costs about $7.50. If the crystal manufacturers are able to turn out thousands of them at a time the price could drop to about half of that. It's up to you.

Should 34–94 become a national calling pair, it is possible that an autocall system could develop. That would be nice too. As it is, in the larger cities, you have to check into a dozen or so repeaters when you are looking for one particular fellow since he might be using any repeater. Or none. So use the phone, right?

Down Links

Okay, the FCC is showing signs of becoming unfriendly and hardnosed about Techs above 147. Big deal. The whole two meter band should have been opened to Techs years ago – you know it, I know it – and the FCC knows it.

If the FCC has any bitch about the way amateurs are giving the Tech exams they should make their gripe public and work out a way to solve the problem. If the technical exam for Tech license is exactly the same as the one for the General license – and it is – then why should there be any difference between the two meter allocations for the Generals and the Techs? Particularly in the 147 MHz segment of the band there is no question of code or CW and that is the ONLY difference between the licenses.

Perhaps there is a little reason to keep the Techs out of the virtually unused CW band at the low end of 144, though little of the CW that does get used there is above the Tech 5 wpm speed limit. This part of the band swings into action during aurora and very slow speed code is the way you work via aurora, not high speed. Be that as it may, the FCC could certainly open 147–148 any time with no harm done to anyone – and they should.

Until they do open this part of the band for Techs, this is not a bad place to put repeater inputs for use by General class licensees where the repeater is down linked to a General class band such as ten meters or the upper part of 20m.

Say we take a 19–79 repeater and put a second priority input on 147.39 which, when used, would have its output on 79 and also on 29.68 MHz. This would get around the problem of Techs being repeated on 10m and keep some of the FCC engineers in charge with nothing better in this world from harassing us. It is too bad that some of them, like Atems in Detroit, have so little interest in the CB mess that they have time hanging heavy on their hands and spend large gobs of our money strictly enforcing almost unbelievable interpretations of obscure and long uneeded rules.

Hopefully your repeater group will take an interest in down links and set up some. This will greatly enhance the value of your repeater. If your group is interested in providing first rate emergency service then you can hardly refuse to set up a down link to the service nets on 40m, Midcard on 7255 and Eastcars and Westcars on 7258 kHz. A simple sideband transceiver connected to your repeater will enable this down link to be used for reporting emergencies. There are hundreds of ears monitoring these nets night and day so you will be able to expand the service you provide enormously by tying into the nets.

Links to 10m will enable you to work through your repeater and out to a western repeater – through a link back up to 2m again. That comes under the heading of fun.

Northeastern Repeater Association

The repeater groups of the northeastern part of the country are now mulling over the constitution and by-laws of the Northeastern Repeater Association (NRA), trying to decide whether they want to join or not.

There is no question that an organization of repeater groups is needed. Every time there is any sort of meeting announced the representatives of repeaters turn out in great numbers and anxious to get on with solving the many problems involved in coexisting. The reasons for some hesitation as far as jumping into the NRA have to do with its short, but checkered history.

The first meeting, held early this year in Pennsylvania, came as a surprise to most of the New England repeater groups, who were not only uninvited, but feel that the meeting was perhaps intentionally kept a secret from them. This meeting seems to have been prompted by a fear by a few people that the FM Symposium announced by 73 and hosted by the Worcester Radio Club would be a success. The idea apparently was to steal the thunder from the symposium, hence the secrecy.

The Pennsylvania meeting resulted in several important frequency allocation agreements and certainly was worth while from this aspect. The NRA was "organized" at this time with Gordon Pugh W2GHR as president and Bob Peterson K2IEZ as vice president. Since both of these chaps are extremely controversial in FM circles this choice spread more consternation than confidence among the New England repeater groups.

The second meeting of the NRA in Weston (Mass.) steam rollered over even the most sturdy voices of protest and did not increase confidence. Bob Waters W1PRI and Bruce Marcus WA1NXG, probably the two most controversial amateurs in New England FM, appeared to be working hand in glove with Pugh and Peterson. More consternation.

The third meeting, in Hartford in April, surprised those present when the announcement was made that the president was now Bob Waters and Pugh was vice president. Peterson had dropped out. The representatives of K1FFK on Mt. Greylock raised a very loud howl about Pugh being any officer of NRA at all in view of his actions with WA1KFX (see page 10, June 73). They felt that this was deliberate jamming of their repeater and that any individual who would do such a thing had no business having an office in a repeater association. The representatives of about 80 repeaters present for this meeting were not happy to find that the meeting was taken over almost entirely for the reading of a proposed constitution and by-laws of the NRA instead of getting down to brass tacks and trying to solve the problems that the groups had come there to work on. Many felt that the meeting was a tremendous waste of time.

After the meeting representatives of repeaters with special problems got together to see what could be done to solve channel problems. Pugh finally agreed at this time to shut down his Mt Snow repeater which was clobbering K1FFK a few miles away. A long hassle with Frank W2OCM came to naught when Frank refused to consider any negotiations, thus forcing the Bridgeport repeater WA1KGK to be the only one in New England not on a 600 kHz pair.

Two months after the April NRA meeting copies of the proposed consti-

(continued on page 136)

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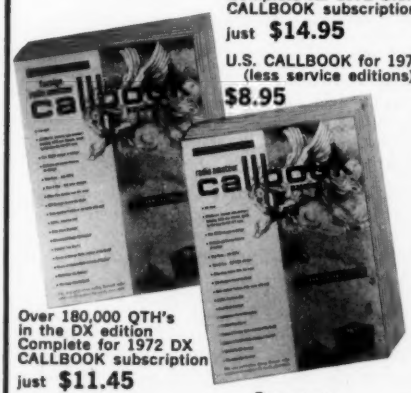

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Now I am a HWFO – a *Ham Wife of the First Order*. That is a license toting ham XYL. And I am going to give you a few pointers on how to turn that HHRW of yours into an HWSO. A *Ham Wife of the Second Order*. That is a ham wife who doesn't actually have a license, but neither does she despise your hobby. As a matter of fact her attitude varies from "live and let live" to a genuine interest. Either way she has learned to accept you with as much grace and aplomb as the situation permits, for better or worse and ham radio. How do I qualify to give you these instructions? Well, even though I acquired my Technician license before I married W7UVI (I don't think he would have married me otherwise) there were times – and still are a few – when his hobby irritated me to death. So you can imagine what these same things must do to a bona fide HHRW. So if you want to hang on to your wife *and* your radio, pay close attention.

Rule No. 1. Don't call CQ five minutes before you are supposed to go shopping, to the movies, or to your mother-in-law's for dinner. The guy you contact will no doubt be running the new Starduster 13, the greatest rig to hit the market, and it's the first one you have heard on the air. Now I would judge this contact to be worth at least thirty minutes. You only have five, remember? Another possibility is that the OM who comes back to your CQ just happens to have served on the U.S.S. Goldfish, the very same ship you served on, and about the same time, at that. This contact is worth at least one hour. Or consider this: You call CQ and get an answer. You manage to give and receive all the vital statistics . . . QTH, handle, signal report and sign, all in five minutes. Aren't you proud of yourself? You reach to turn the rig off – but hark! What is that you hear coming faintly through the QRM? Could it be? Is it possible? YES, it is! An XYQØAB in Lower Slobovia calling you! You have never even heard one, let alone worked one. But as you reach for the mike to answer him, the hairs on the back of your neck stand up. A quick glance over your shoulder confirms your suspicions. Your HHRW is standing there looking at you and saying, without even opening her mouth, "If you touch that mike I will *kill* you! We are leaving NOW!" So why risk a five minute QSO? If you, like my OM, find yourself compelled to call CQ at these inopportune

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  Big deal? You'll know it is if you get a set where you can't zero the receiver.
- **Front speaker**
  Most sets have the speaker aimed up under the dash or at your feet with the result that you can't hear diddely beans. The front speaker can be heard, even when you are driving.
- **10 watts.** Also 0.1 and 1 watts, switchable.
  Big deal? Have you thought how easy it is to make this little set into a shoulder unit with a small battery pack? The low power position is excellent for this.
- **Very, very small.** Tiny, in fact. Mounts anywhere.
- **Minimum adjacent channel interference.**
  The ceramic filter eliminates most adjacent channel spillover. You may not appreciate this unless you've tried a couple of other sets and found them unusable anywhere near a strong signal.
- **S-meter.**
  Big deal? How many sets in this price bracket have an S-meter and power output indicator meter? The S-meter is very handy.
- **Includes matching mike,** mounting bracket, etc.
- **Available with tone burst** encoder built in and tested.
  Ross & White also makes these tone burst units and sells them. Send for prices and info.
- **Can you do without** this terrific FM unit one more week? Don't miss any more of the fun on 2m. Instant delivery, prepaid!

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times, try this therapy. Go into the ham shack but don't turn on the rig. Not even the receiver. Grab a dust cloth and start dusting. How do I know your shack is dusty? Because no self-respecting HHRW would set foot in a ham shack, let alone dust it! Or you could pick up the tools you left out the night before when you were troubleshooting the rig. Try sitting down and writing out QSL's. But whatever you do, don't pick up that mike!

Rule No. 2. As you come home one evening to find the baby crying, the older harmonics fighting, and your wife throwing out a batch of cookies she burned because the stupid timer wasn't working – don't head for the seclusion of your ham shack. (That is, if you want to cultivate an HWSO – if you enjoy living with an HHRW, then go ahead.) If you choose the former, here's what you do. Disengage the screaming toddler from your XYL's leg and shut him up. A cookie will usually do it, if you can find one that isn't charcoal. Then send the feuding harmonics outside, or to their rooms, or anywhere out of their mother's hair. You might even try to fix the "stupid" timer. Later, when the kids are in bed and your XYL is ensconced in front of her favorite TV program, you can enjoy your hamming with the knowledge that you aren't adding fuel to your HRRW's dislike of your hobby.

Rule No. 3. This involves the source of all evil . . . money. Or the lack of it. If your wife needs a new coat, the harmonics all need new shoes and you haven't paid last month's doctor bill, don't go out and buy a new Fantastic 4 Transceiver or a new HANDY, DANDY-SOOPER-DOOPER tower. After all, what would you rather have, these frivolous things or a wife? On second thought don't answer that. Just try to use a little common sense and a hell of a lot of will power when it comes to spending money on your first love. Yes, we XYL's know it is your first love, but we appreciate it if you don't keep reminding us the fact too often.

Now if you follow these few rules I can't guarantee you will change your HHRW into an HRSO, but I think it's worth a try, don't you?

. . .K7TCU

H. Peter Fischer VE3GSP
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Oakville, Ontario

$5 PREAMP COMPRESSOR

Recently I purchased an HW-100 Heath transceiver, and with it came the need for a mike. I had one, but it was a low-Z high quality thing, and I was faced with the problem how to match this to my high-Z input of the HW-100. I made up a transistorized preamplifer from a circuit in the GE transistor manual. This furnished me with a high impedance output and more signal than I could use.

I had heard about speech compressors, but never thought they could do anything for me. Because after all, my rig had an effective alc circuit, and that should do the trick. And then, one Sunday morning on 10m, I listened to a German station demonstrating his voice transmission with and without a speech compressor. That did it! What a difference it made. The S-meter gained 6 dB and his voice punched through the QRM. It wasn't even funny!

I dug through all my 73 back issues and found two articles on the subject, both by W2EEY (March and June '69). One circuit was his own design, the other a review of a commercially available unit: the "Caringella ACP-1." The specs on the Caringella look extremely good and the circuit is very well designed, but it was priced in the $20 bracket as a kit and rather large. It couldn't be built into an existing transceiver.

The next thing I did was measure just how much compression is needed by watching my voice amplitude on a storage scope. I could see intense and weak speech passages precisely. I found maximum amplitude differences to be 1:20, or 26 dB. So I went ahead and built a Clipper-type compressor that gives easily 20 dB compression without too much distortion. This thing is less complex, easy to build, cheaper, and physically much smaller than other units. I built it on a 1¼ x 1½ in. circuit board, and could squeeze it easily into a corner of my rig. The thing draws 1.8 mA, which I stole from the 250V B+ via a dropping resistor. If you want to play it safe you can stick a zener in there too. The circuit is flexible and features a few minor things that others don't. It takes out low frequency ingredients, particularly below 150 Hz, which makes voices sound as if they came from the bottom of a barrel. Also, gain can be chosen to suit any type of mike, low and hi-Z mikes can be used with output levels from a 0.5 mV–10 mV/microbar sound pressure. Even ceramic mikes with 100 mV output can be used by feeding the signal in at a different point of the preamplifier.

The preamp-compressor has an input impedance of 50 kΩ and output impedance of 100 kΩ. Frequency response (Fig. 1) is flat from 250 to 3500 Hz and drops off softly to –20 dB at 60 Hz and 20 kHz. Input sensitivity is defined to yield an

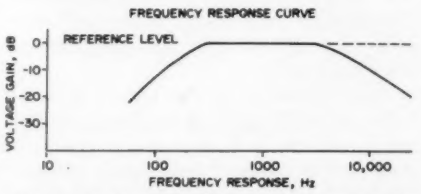


Fig. 1. As the chart shows, the response will be flat in the voice range.

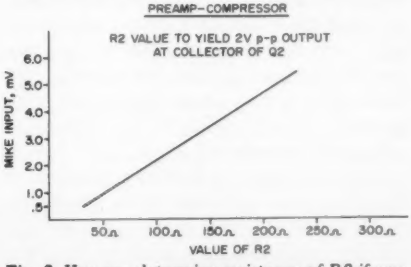
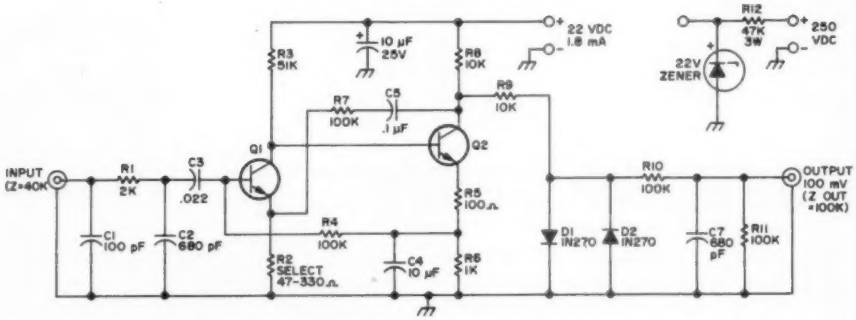


Fig. 2. You can determine resistance of R2 if you know the output capability of the mike you'll be using.



1-Q1 & Q2 ARE Si NPN TYPES, hfe 30-120, VCBo 45V OR EQUIV.
2-SELECT R2 FOR DESIRED GAIN.
3-IF NECESSARY, CHANGE R4 TO YIELD 10-12 VDC AT COLLECTOR OF Q2.
4-IF LOWER OUTPUT IS DESIRED, CHANGE R10-R11 RATIO.

Fig. 3. Schematic, preamp-compressor.

output of 2V p-p at collector of Q2. The gain required can be set by selecting the proper resistance value for R2, emitter resistor of Q1. (See Fig. 2.) If the rms mV output from your mike is known you can select proper emitter resistor from this graph. If mike output is unknown just try 100Ω for a ballpark value; it will most likely do. The whole gain selection is of some importance because the signal at collector of Q2 should not exceed 2V p-p by much. If it does there will be some distortion at the compressed output.

C1, R1, C2 act to filter any rf that gets into the input. C3 couples the signal into the base of Q1. C3 should be a low-Q type capacitor such as an electrolytic to make sure it doesn't pass rf too easily. Q1 amplifies the signal to a 150 mV level. If R2 is increased, gain of that stage decreases and you can input a larger mike signal and vice versa. Q1 is bootstrap-biased from E of Q2 which results in very stable and low distortion amplifier stage. The signal is dc coupled from collector of Q1 to base of Q2. Q2 collector sits at 10–12V dc, which can be influenced with bias resistor R4. Depending if you chose a higher or lower gain Q1 and Q2, this R4 value has to be changed somewhat to get the 10–12V at no-signal. R7 and C5 provide some negative feedback for bass and treble. From the collector of Q2, the signal passes R9 and C6 and sags down via D1 and D2. Here it is important to use the right diodes: they have to be high conductance germanium types which break out easy and gradually. 1N270s will do nicely, and some computer diodes are very suitable.

These diodes will not clip signals as small as 150 mV, but will definitely break out as you increase the signal level. The working resistor R9 and capacitor C7 will smooth off the clipped signal so it looks like a sine wave again. An excessive signal before R9 will cause significant distortion which can be heard easily. The wave shape at the output will look more and more square if the level into the clipper-section becomes too large.

R10 and R11 attenuate the output level to 100 mV, but can be attenuated to other values as well. C7 helps shaping the output wave shape and cuts treble some more. It also shorts any rf at this point.

Since I have been using this compressor over the past few months I made a number of tests on the air, demonstrating my voice without and with compressor. All reports gave me positively more audio punch, and in several cases I could only be copied solid with a compressor – and not without. On DX QSO's voice clarity could not be distinguished except for loudness, whereas local hams in two cases reported a somewhat bassy voice.

So I am sold on it now. I like it because I can sit back and speak gently into the mike even at a 1 ft distance and still observe the output power meter bounce right to the end continuously.

...VE3GSP■

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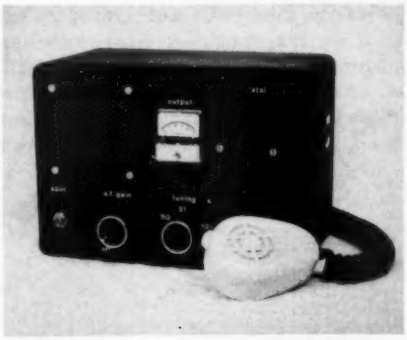
Push-to-Talk for the Sixer

AND OTHER MODIFICATIONS

Breathes there an owner of the "Benton Harbor Lunchbox" who hasn't made some modifications to suit his own needs? My Sixer is mounted in a Volkswagen for mobile operation, and I found it hazardous while driving to manually change from receive to transmit using the panel-mounted switch. So, out came the rig for a push-to-talk modification. And while the little fellow was sitting on the workbench with its innards exposed, a few others changes were made: a spot switch and receiver bandspread. These modifications, plus others that had been made from time to time (the output meter and front panel mounted crystal socket were installed following articles in various ham publications over the past few years), have made the Sixer a real joy to operate. I'm sure the basic ideas described here would apply to the Twoer as well.



Author's "Sixer" ready for mobile operation. New panel is not essential but helps to cover up hole left by removed transmit-receive switch. Note new tuning scale.

Push-to-talk capability was achieved by replacing the manual transmit/receive switch with a 12V dc 4PDT miniature relay. Owing to the nature of the filament circuit, once you've converted the rig to PTT, you can't operate on 115V ac, because the filaments are fed in parallel from a 6V winding on the transformer, and when operating from 12V dc, they are arranged in a series-parallel circuit. Since I intended only mobile operation, this situation did not bother me. Since the filaments operate on 6V, a 6V ac or dc relay across the filament string may be used for the PTT, depending upon whether you prefer fixed or mobile operation. People who use these ubiquitous rigs both at home and in the mobile might try installing a rectifier in the filament string before an appropriate dc relay.

The relay is mounted upside down and against the front skirt of the chassis, using contact cement. No socket is used. The

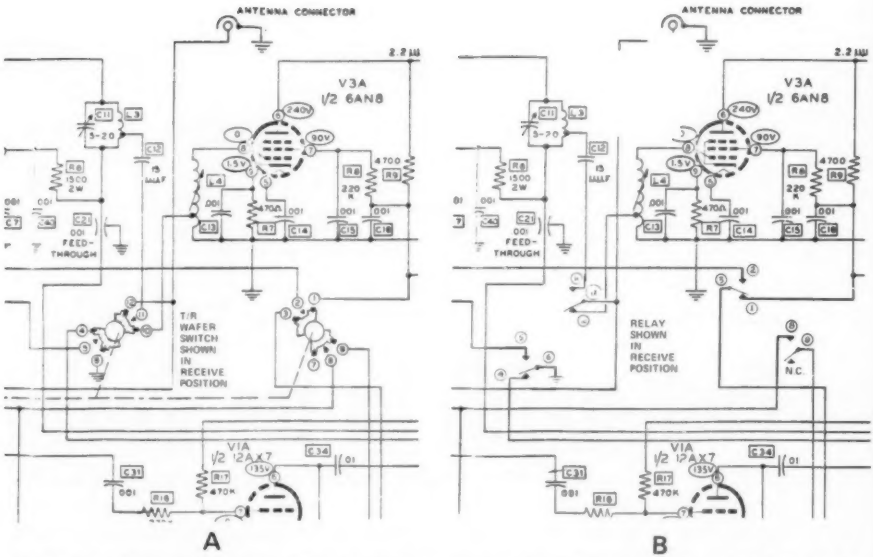


Fig. 1. (a) T/R circuit before modification. T/R wafer switch shown in receive position. (b) T/R circuit after modification. Relay shown in receive position. Numbers in circles around relay contacts correspond to original terminals on wafer switch.

relay occupies the same area originally taken by the wafer switch (see photo), which makes wiring rather easy; just use the wires you removed from the wafer switch and connect them to the relay. Figure 1 shows a "before and after" wiring scheme based on the original Heathkit schematic diagram.

I was a bit apprehensive about making this change, as I felt the intercapacitance between close relay contacts might adversely affect rf output. Before making the change, I measured rf output across a 50Ω dummy load, then repeated the measurements after the relay was installed and the final amplifier retuned. Using my simple measuring techniques, I could detect no reduction in rf output.

Voltage to operate the relay is taken from the 12V filament circuit. Figure 2 shows the relay actuation circuit. The relay is operated by a microphone with a push-to-talk switch built in. A suitable microphone jack can be installed in place of the original jack on the front panel, or on the rear skirt, if you want to add the spot switch described next. Since my Sixer has an output meter, I removed the meter jack and reamed out the hole on the rear skirt to accept the microphone jack. Be sure to use a high impedance microphone.

I can't say the spot switch I added lets you *pinpoint* your crystal frequency on the dial, owing to the very broad tuning characteristics of the receiver. But it is a help when there are several stations around your operating frequency, and you want an inkling of where your signal is going to fall. A SPST (momentary-make or standard toggle) switch is mounted on the front panel and connects a 47,000Ω, 1 watt

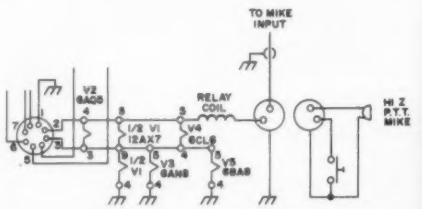


Fig. 2. Relay actuation circuit.

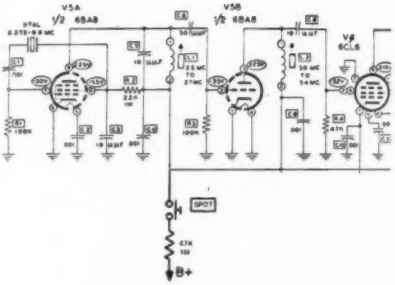


Fig. 3. Spot switch circuit.

resistor between a source of B+ and the plate of oscillator tube V5A, as shown in Fig. 3. The resistor keeps the plate voltage low enough so the oscillator output doesn't overload the receiver, and tends to make spotting a bit more accurate. (Even with this reduction in output, the spot signal covers about 15 degrees of tuning dial rotation!) The broad tuning and lack of selectivity led to the next modification – bandspread.

Bandspread

Most of the activity on six meters in my part of the country seems to fall between 50.2 and 51 MHz, with a great concentration of stations around 50.4 MHz. With the Sixer covering 50 to 54 MHz, this meant that most of the stations I work fall within a two degree span of the dial. Ridiculous!

I very carefully removed one of the two rotor plates from the receiving tuning capacitor, then soldered a 1.5 to 8 pF trimmer across the capacitor terminals. I adjusted the trimmer so that the receiver tuned from 50 MHz to around 52 MHz.

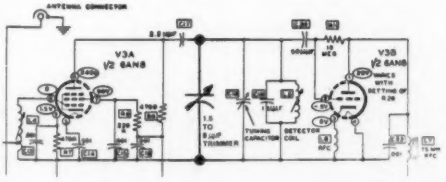


Fig. 4. Bandspread circuit.

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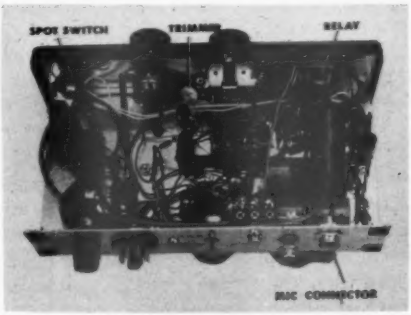

Sixer underchassis shows location of added components.

This doesn't really change the selectivity characteristics; it merely spreads the stations out a bit. It does make a difference when mobiling, however, and I found it to be worthwhile. Figure 4 shows the circuit change.

My thanks to Bob Wille, K2RQU, for his help during testing the modifications, and to Court Packer for his photography.

. . .WB2WYO■

PAINTING METER BEZELS

William P. Turner WAØABI
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Saint Peters MO 63376

One of the major problems confronting the homebrew artist in making his equipment look as if it were custom-constructed is the American standard black meter bezel. If you happen to like black equipment you are in luck, but if you are partial to green, grey, or brown . . . well, sorry about that.

There is a way of matching any panel color. I stumbled into it quite by accident, after looking high and low for a dark green meter to match SB series green. The same approach is equally applicable to the usual clear plastic bezels found on imported meters.

Your local hobby store, 5 & 10, or drug store sells a paint intended for use on plastic model cars, airplane, and the like which works beautifully on meters. The color selection is quite wide and if you can't find exactly the shade you need you can always mix two or more colors. The answer to my particular problem was one jar of "leaf green" and about 3/4ths of a bottle of black. The price is low, so you needn't worry about the cost of experimentation. This type of paint is very forgiving, it being almost impossible to leave brush marks. Nonetheless, use a good brush and mask off the area to be painted if you hand isn't steady. Your project is guaranteed to look much more professional.

. . .WAØABI

PLEASE INCLUDE YOUR ZIP CODE WHEN YOU WRITE 73.

PROPAGATION CHART
J. H. Nelson

Good (Open), Fair (□)

AUGUST • 1972

S	M	T	W	T	F	S
		1	2	3	□4	5
6	□7	□8	9	10	11	12
13	□14	□15	□16	17	18	19
□20	21	22	23	24	□25	□26
□27	28	29	30	□31		

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	14	14	7	7	7	7	7	7	7	14	14	14
ARGENTINA	14	14	14	7	7	7	14	14	14	14A	21	21
AUSTRALIA	14	14	7A	7B	7B	7	7	7	7	7	14	14
CANAL ZONE	14A	14	7	7	7	7	14	14	14	14	14	14A
ENGLAND	7A	7	7	7	7	7	14	14	14	14	14	14
HAWAII	14	14	7B	7	7	7	7	7B	14	14	14	14
INDIA	7	7	7B	7B	7B	7B	14	14	14	14	7	7
JAPAN	14	14	7	7	7	7	7	7	7	7	7A	14
MEXICO	14	14	7	7	7	7	7	14	14	14	14	14
PHILIPPINES	14	14	7B	7B	7B	7B	7B	7	7	7	7A	14
PUERTO RICO	14	7	7	7	7	7	7	7A	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	14	14	14	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	14	14	14	14	14	7
WEST COAST	14	14	7A	7	7	7	7	14	14	14	14	14

CENTRAL UNITED STATES TO:

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SOUTH AFRICA	7	7	3A	7	7B	7B	14	14	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	7	7A	14	14	14	7

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AUSTRALIA	21	21	21	14	14	14	7	7	7	7	14	14
CANAL ZONE	14A	14	14	7	7	7	7	14	14	14	14	14
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PUERTO RICO	14	14	7A	7	7	7	7	14	14	14	14	14
SOUTH AFRICA	7	7	3A	7	7B	7B	7B	7B	14	14	14	7B
U. S. S. R.	7	7	7	7	7	7	7	7	14	14	14	14
EAST COAST	14	14	7A	7	7	7	7	14	14	14	14	14

A = Next higher frequency may be useful also.
B = Difficult circuit this period.

F. Dale Williams K3PUR
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State College PA 16801

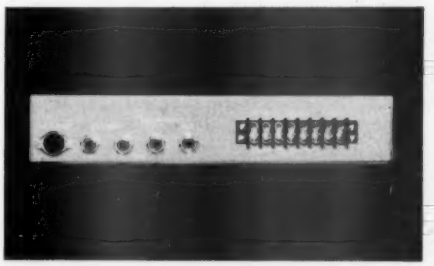
Audio Distribution Control and Phone Patch

Some time ago I decided that I was missing out on some of the fun of amateur radio due to the lack of a phone patch in the station inventory. Therefore one was constructed using junkbox parts and incorporated into another piece of equipment under construction at that time. However, the performance left something to be desired in that the hum level was high (no hybrid transformer in the junkbox), there was no way to monitor the amount of audio being fed to the phone line, and operation required disconnecting cables from the receiver and transmitter, reconnecting them to the phone patch, and reversing the procedure to return to normal operation. A recent redesign of the station made the original equipment which contained the phone patch obsolete, thus giving me a good excuse to redesign and rebuild the phone patch into a separate enclosure.

The audio distribution control unit described here is designed to be used as a phone patch, audio distribution system, and control of transmit/receive functions. Connections to the desired equipment are made by front panel lever switches which incorporate a lamp and different colored filter for each switch position. Different colored filters are supplied with the switches allowing those in different positions to be

Front view of Audio Distribution Control

Rear view of Audio Distribution Control.



color coded similarly when connected for normal operation, phone patch, etc. No extra controls are included for audio level adjustment, since this can be done at the receiver and transmitter. A VU meter is available to assure that the audio level being coupled to the phone line is not above that specified by the telephone company. The meter operates whenever a signal is applied to the hybrid transformer and may also be used to monitor the tape recorder input and output. When S2 is in the Aux/Patch position, the microphone input is disconnected from the transmitter and a DPDT relay is activated. Each of the two activated relay contacts are connected to three terminals on the rear panel and to ground. This arrangement allows transmitter power relays, receiver muting relays, and antenna relays to be activated by the audio distribution control unit when they are connected to the terminal board on the rear panel. This is a good method to activate the transmitter and auxiliary equipment for RTTY operation.

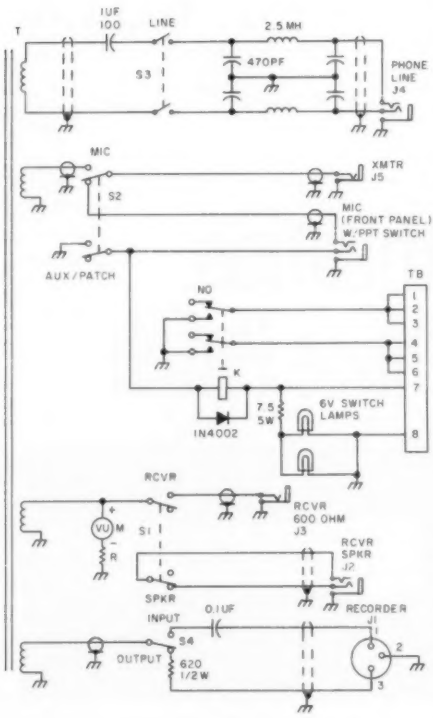


Fig. 1. Schematic of audio distribution control: T – c111 Telephone Retardation Hybrid Transformer, Herbert W. Gordon Company: $5.95. K – 12V, .13A, Sigma Relay Number 50F2, Allied Radio; $3.60. M – VU Meter Number 24A9332, Allied Radio; $3.50. R – Included with VU Meter. S1, S3 – Switchcraft Lever w/Lamp Number 25308, Allied Radio; $3.30. S2 – Switchcraft Lever w/Lamp Number 25312, Allied Radio; $3.60. S4 – Switchcraft Lever w/Lamp Number 25306, Allied Radio; $3. J3, J5 – 2 Connector Phone Jack. J1, J4, J6 – 3 Connector Phone Jack. (Do not use long patch panel jacks.) J1 – see text. TB – Cinch-Jones Terminal Barrier Number 8-140-Y, Allied Radio; $.88. Chassis – Bud 7 x 11 x 2 in., Number AC-407, Allied Radio; $1.80. Bottom Plate – Bud 7 x 11 in., Number BPA-1594, Allied Radio; $.90.

Construction

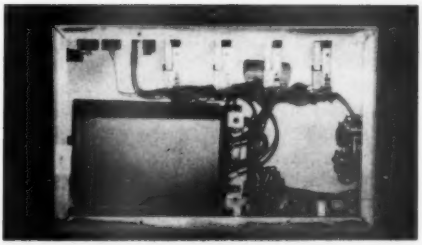
Although there are many different approaches to construction, the following procedure assures that no necessary steps are left out and that the end item presents a good appearance as well as being functional.

Fig. 2 shows the chassis and bottom cover with the necessary measurements for drilling. All views of the chassis are shown with the open side down, and all measurements are to the center of the openings to be made. Before starting to make measurements, mark the chassis for front, back, and right side. Beginning with the right side, mark and drill the relay mounting screw hole. The small rectangular slot, which keeps the relay from turning after mounting, may be made by drilling one 1/16 inch hole on either side of the center point and squaring with a small flat file. Hold the relay in mounting position to be sure that the holes match, then clean all burrs from the edges of the openings.

Mark the rear of the chassis for the jack openings as shown. The diameter of the tape recorder jack, J1, will be determined by the type of jack used. It may be a normal 3-connector jack, 3-connector microphone jack, or European-type jack as shown in the picture of the audio distribution control unit

Drill the holes for the jacks and assure that they are large enough before deburring. The terminal board, TB, is fitted with wrap-around posts which extend through the chassis. Two methods, depending on the

tools available, can be used to make the necessary opening. If a metal nibbling tool is available, mark a horizontal line 1 inch high and approximately 4 inches long from the right-hand edge of the chassis. Make a mark on this line 1 1/8 inches from the chassis end. Holding the terminal board to the rear of the chassis so that the wrap-around posts are on the line and the right hand terminal is approximately 1/16 inch to the left of the 1 1/8 inch mark, make a point on the horizontal line approximately 1/16 inch to the left of the left hand terminal. Drill a 1/4 inch hole anywhere between the two points on the center line, and use the nibbling tool to make a rectangular opening between the points as shown on the diagram. Hold the terminal board to the chassis and mark the points for drilling the mounting screw holes, assuring that the wrap-around posts are centered in the opening. Clean any burrs from the edge of the opening. If a nibbling tool is not available, hold the terminal board to the chassis so that the wrap-around posts are on the horizontal line and the outside raised Bakelite insulator of the right hand terminal corresponds to the 1 1/8 inch mark on the line. Make points on the line at the center of every wrap-around post and drill 1/4 inch holes at all these points. Hold the terminal board to the chassis and mark points for drilling the mounting screw holes, assuring that the terminal board is parallel to the chassis and all wrap-around posts are centered in the holes. Deburr all openings.



Bottom view with cover plate removed.

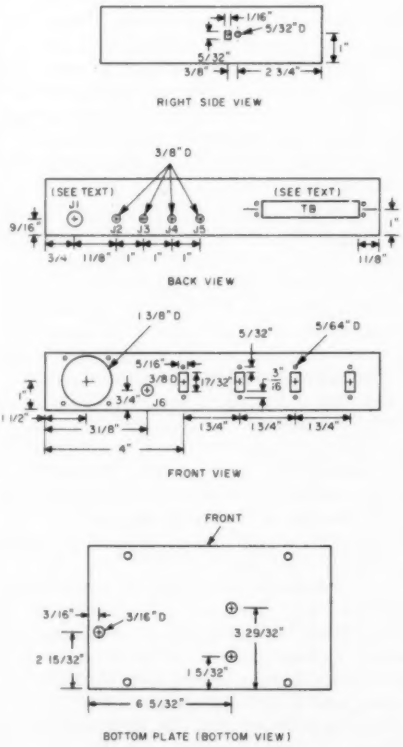


Fig. 2. Right side, back, and front, bottom plate chassis layout.

To mark the front panel for drilling, measure 1 inch from the bottom edge of the chassis and draw a horizontal line from one end of the chassis to the other. Make cross marks on this line at all points corresponding to the measurements on the diagram. Check the diameter of the meter housing before making the hole. Points for the meter mounting screw holes can be marked where the screws touch the chassis when the meter is partially inserted in the opening. Be sure that all screws are perpendicular to the chassis and meter plate and the meter is in the correct position before marking the chassis. An alternate method is to make a paper template from the meter or use the cardboard mounting strip from the package. The hole for J6 is drilled similar to those on the rear panel. The openings for the switches may be made by drilling a 1/4 inch hole on the point and using files or nibbling tool. In either case lines designating the perpendicular sides of the switch openings should be drawn on the chassis to preclude making an angular hole. Points for drilling the switch mounting screw holes can be found by inserting the switch lever through the hole from the outside and marking through the

holes on the mounting plate. Be sure that the switch is right side up when inserted, if the chassis is in this position. File all sharp edges and deburr all holes.

An additional three holes are necessary in the bottom cover for mounting the transformer. Mark one long side of the cover "front" after placing it with the bottom side up. Make all measurements with the front side of the cover facing away from you as shown in the diagram. After marking the left edge hole, place the cover on the upside-down chassis, assuring that the front of the chassis corresponds to the front of the bottom cover. Square the cover on the chassis and clamp in position before drilling. The holes may be drilled separately if clamping is not possible. The diameter of the two center holes will depend on the size of the screws to be used. Their length should not be over 1/4 inch. Self-tapping metal screws should be used for attaching the bottom cover.

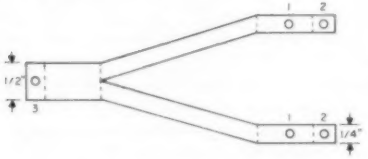


Fig. 3. Transformer bracket drawing.

The shape of the hybrid transformer presents some mounting problems. To overcome these problems, the clamp shown in **Fig. 3** can be made from thin aluminum sheet, tin, or some similar material. Exact measurements will depend on the material used, since a lighter metal will bend easily without much loss in dimensions. The V-shaped section fits over the flat top side of the transformer, then both ends are bent down. The holes designated by the number 1 on the diagram are drilled in the center of this section to fit over the bolts on the base of the transformer. The original nuts are used for fastening. Sections numbered 2 and 3 are then bent up so that they are flush with the bottom of the transformer. Place the transformer with clamp attached on the inside of the bottom plate so that sections numbered 2 on the clamp equally cover the center holes and section 3 covers the hole drilled on the edge of the plate. Be sure that the transformer is parallel to the edges of the cover before marking sections 2 and 3 through the bottom plate holes. Drill holes corresponding to screw size and deburr.

Wiring

The wiring of switches always requires concentration and seldom is completed without at least one pair of wires reversed.

A ground bus wire is used at the switches for the connection of the shields of all audio cables terminating at the switches.

As can be seen from the schematic, the phone patch output to the transmitter is direct. For transmitters with high impedance inputs, a matching transformer or transistor preamp will probably be necessary. A diagram for rewiring the first audio stage of the transmitter is included with the hybrid transformer when supplied by Herbert W. Gordon Company. This solution may assist builders with high impedance tube input stages. The .1 μF capacitor on S4 matches a tape recorder input impedance of 2 kΩ while the 620Ω resistor will allow the transformer to see an almost equal impedance with a slight loss of gain due to the mismatch of most recorder outputs. However, gain is not a problem since regulation at the recorder provides more than enough. These values may be changed to suit the builder's needs.

Mount all switches in the chassis, using one screw for each. Since the chassis is upside down, be sure that the switches are the same way. Push the VU meter into position, but do not fasten. Loosely mount all jacks, the terminal board, and the relay.

Cut a piece of number 12 or 14 copper wire or bus wire approximately 1 inch longer than the distance from the first to the last switch. This ground bus should run along the rear of all switches about 1/4 inch from the bottom contacts and all cable shields should be soldered to it. All audio cables should run along the rear of the switches to a point in front of the transformer.

The transformer may be temporarily placed upside down in the chassis and a pencil line drawn parallel to and approximately 1 inch in front of the transformer terminals. All audio cables from the switches to the jacks follow this line to the rear panel where they branch out to their respective jacks.

If cable lacing or clamps are to be used, remember to leave enough slack at the switches, places where the cable run turns,

and the jacks. Begin the wiring with the front panel jack, J6, and continue with the other wiring. The filter components for the phone line may be mounted behind the jack, J4, and the two-conductor shielded cable from the filter to the switch.

The capacitor and resistor for the recorder lines may be mounted between the switch and shielded cable. After completing the audio cable hookup from the switches to the jacks, the audio wiring from the switches to the transformer can be done.

Measure the meter resistor from the negative meter lug to the closest meter mounting screw and cut the leads to this length. Shorten one lead and connect to a solder lug to be placed over the meter mounting screw. Do not connect the meter at this time. After all audio cabling is completed, with the exception of the transformer connections, a continuity test should be performed with an ohmmeter to assure that all connections are correct. When this check has been completed, the cables, with the exception of that section of the cables leading to the transformer, may be laced or tied with cable clamps.

Wiring from the relay to the terminal board should be done next. Do not solder any wires to the terminal board posts until so stated. Keep the wires along the bottom edge of the chassis.

A wire from the open contacts on the relay can be run to the ground bus and soldered. Run two wires from the switching relay contacts to terminals 2 and 5 on the terminal board. Mount the 7.5Ω resistor on the bottom edge of the chassis and bend one lead to pin 7 on the terminal board.

Place a piece of spaghetti on this lead. Run a wire from the remaining side of the relay coil to pin 7 on the terminal board. Attach one wire to pin 8 and one wire to the other end of the dropping resistor. Use insulating tape or shrinkable tubing to prevent the solder joint from inadvertently shorting to the chassis. Run these two wires along the bottom edge of the chassis to the lamp contacts on S1 and connect. Twisted extra pairs can be used to continue the lamp wiring in parallel. Solder all lamp connections. The power wires may now be laced or clamped from S1 to the terminal board if desired. If the previous instructions were followed the lamp wiring will not be laced or clamped with the audio cables and burned out lamps can be easily replaced.

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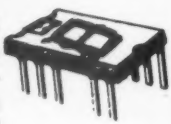

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DX WORD GAME

(see page 145)

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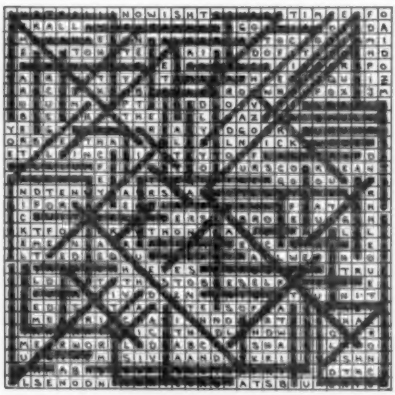

There are probably more DX countries in here — but these are all *we* could find.

When preparing the audio cables for connection to the transformer terminals, keep in mind that enough slack must be left to allow a hand and wrench to be inserted between the chassis and bottom cover to tighten the transformer clamp nuts to the screws which still will be inserted through the bottom cover. At least 1½ inches clearance should be allowed. After soldering the audio cables to the transformer, run a wire from the ground bus to the nearest leg of the transformer clamp. Solder one end to the ground bus and the other end to a solder lug large enough to fit the transformer clamp screw. Be sure that all terminals used as shield grounds on the transformer are also connected to this lug for grounding. A small bus wire will work well. Check J5 and turn if necessary to keep it from shorting to the transformer mounting clamp when the bottom cover is attached.

Operation

To use the phone patch, place the PTT microphone switch to Off. Dial the given number on the telephone. While explaining to the person on the other end of the line what is happening and why he must say "over," turn the audio gain on the receiver down to about one-fourth of normal and put S1 in Patch position. When you are ready to start, put S3 in Line position. The phone line is now connected to the audio distribution control, and throwing S2 to Aux/Patch will activate the transmitter. You may identify through the microphone of the telephone handset and monitor through the earpiece. The receiver audio gain should be set so that peaks are not above "0" on the VU meter. The transmitter audio should be set for a normal meter indication.

To use the audio distribution control unit as a station transmit/receive relay, as in RTTY or CW operation the PTT switch on the microphone should be Off and S2 moved to the Aux/Patch position. All other switches remain in their normal position. In those stations where VOX or break-in CW is desired, the relay in this unit may be used with your existing circuitry, with minor circuit changes in the relay connections.

With this new unit patching, audio anywhere necessary is a simple matter, and the relay offers versatility in controlling station functions.

. . . K3PUR

James J. Wenskus, Jr. K2BEH
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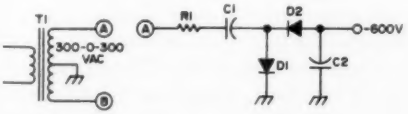
Rochester NY 14626

ECONOMY VOLTAGE MULTIPLIER FOR SCOPE HV SUPPLIES

Smile when your power supply burns up and fills your shack with evil-smelling smoke.

The bulky and expensive high voltage transformers quite often used for scope power supplies are unnecessary and obsolete. Here is a modified voltage multiplier circuit that will replace them. It even uses fewer components than the standard voltage multipliers.

Recently my 20-year-old oscilloscope main power transformer developed an internal short and burned up. I was rather dismayed, as I had built several scopes myself and was quite familiar with the problems involved in the scope power supplies. The power supply was always the least enjoyable, most costly, and most frustrating part of the construction. In this



R1 – 1.5K
C1 – .25 μF, 1 kV
C2 – .5 μF, 1.5 kV
C3 – .25 μF, 1 kV

Fig. 1. Standard voltage doubler circuit.

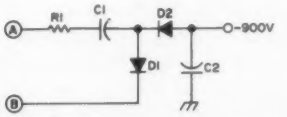


Fig. 2. Modified voltage multiplier. It is now operating as a voltage tripler. If T-1 had a higher rating, such as 375V, this circuit could well be adequate for most scopes.

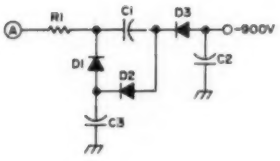


Fig. 3. Standard voltage tripler.

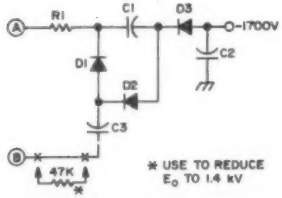


Fig. 4. Modified voltage multiplier. It now appears to operate as a voltage sextupler.

particular case, the possibility of directly replacing the transformer was not practical as it had a special winding to supply the HV to the scope rectifier along with the B+. This meant, of course, that two transformers would normally be required for replacement. With the current cost of transformers as high as it is, the repair prospect was quite gloomy.

I have built several special purpose RTTY oscilloscopes and have always found a considerable magnetic distortion problem to exist when they were completed. In all cases these problems were traced to the 1500V transformers used for the scope power, even though they were described as "shielded." To compound the problem, there is usually very little choice of alternate locations further away from the CRT for this transformer in most scope cabinets. Using CRT magnetic shields was never more than partially effective in these cases. Since these scopes were usually for a relatively non-demanding display, I usually just decided to live with the problem and ignore it. Unfortunately, this was my main development scope that had just quit, and I couldn't stand any magnetic distortion in its displays.

Since high voltage semiconductors are now readily available and quite inexpensive, I decided to go the voltage multiplier route for scope power. I installed a 300-0-300V power transformer to take care of the B+ requirement and started trying the voltage multiplier circuits.

The first circuit that I tried was a voltage doubler. It worked and provided 600V. The scope trace, on a 5BP1, could generously be described as feeble. For some reason I felt particularly inspired that day, so I tried an experiment. I lifted the grounded end of D-1 and connected it to the opposite side, point B, of the power transformer. Well! Three very interesting things happened:

(1) 900V was generated.
(2) The scope trace improved from feeble to mediocre.
(3) Smoke – the 600V capacitor, C-1, shorted.

I obtained some 1 kV capacitors and continued experimenting by going to a voltage triplef to see what it would do under similar conditions. The standard tripler gave 900V as was expected. I lifted the grounded end of C-3 and connected it to point B of the power transformer and:

(1) Pinned the needle on the 1.5 kV scale of the VTVM.
(2) The trace became bright and sharp.
(3) Smoke – all the 1 kV diodes shorted out.

The circuit was rebuilt and installed in the scope. I used 1 kV bathtub capacitors for C-2 and C-3 and two series connected diodes for D-1 – D-3. Shifting to my VOM which has a 2.5 kV scale, I found the output of the circuit to be approximately 1.7 kV. As my original filter capacitor, C-2, was only rated for 1.5 kV, I had to reduce this voltage in order to keep from overstressing it. This was done by putting a 47K resistor in the "B" leg of the multiplier. This brought the voltage down to about 1.4 kV.

I am not familiar with the analysis of this circuit, but I feel certain that someone will eventually supply a nice erudite complex analysis of it, as well as extending its application and modifying it for improved performance.

. . .K2BEH■

Ralph Orozco, Jr. WB6FVW
2081 Bolero Avenue
Hayward CA 94545

VFO OPERATION FOR THE TWO'er

This article may be of some interest to newcomers in the 2 meter band, or even some amateurs who might be tired of being rock-bound. Maybe you might want to check in on a club net, or break in on an interesting QSO. Vfo operation would be handy on Field Day, or to do a little DX chasing. If you were to buy half a dozen crystals or so, you would have spent enough money to build a good solid-state vfo or perhaps buy one cheap at a club auction.

For this article I used the equipment on hand, which was a Heath HG10 vfo and a Twoer (HW30). The receiver being what it is, there is a disadvantage not being able to spot the vfo frequency on the B-R-O-A-D regenerative receiver. There is a way to solve this broadness. If you haven't already converted your Twoer receiver, as described in an article titled "More Selectivity For The Twoer" in the June 1963, *73* I recommend the conversion. It is well worth your effort! It makes the receiver usable.

I might add that several members of the Hayward Radio Club, including myself, use Twoers on the club net, with the receivers converted as described in the article. We are very satisfied with the results.

The vfo coupling circuit description is simple and parts cost little or nothing. The HG10 vfo covers 80 through 2 meters and is a fairly stable vfo. The output circuit is a low Z cathode follower, with a common ground return. The Twoer uses a Pierce oscillator which does not have a common ground on the crystal oscillator.

This means that the vfo output cannot be directly coupled to the Pierce oscillator.

The vfo was link coupled to an 8 MHz series tuned tank for load isolation and impedance matching. I found it necessary to isolate the 8 MHz tank from the screen dc voltage in the Twoer. C1 of the 8 MHz tank is the dc blocking condenser. The 8 MHz tank was built on a crystal socket holder, so it could simply be plugged in and out.

Perhaps you might want to make a more permanent setup and use a DPDT switch. One thing of importance is to make sure the one turn link is kept from moving once the tank is tuned. The 8 MHz tank is sharp and moving the link will cause detuning. Keep the link secured well.

Tune the 8 MHz tank for resonance in the middle of the band. The length of the output cable from the vfo will change C1 somewhat from the value shown.

The method used for spotting the vfo frequency on the receiver is to key the Twoer oscillator coil (L1) and the B+ bus from the transmit function switch. In the forward direction, the transmitter with the diode works normally. In the reverse direction, it keeps B+ from the rest of the transmitter circuit when the oscillator is keyed. I might add, other types of vfos could be used with the Twoer as long as the coupling circuit remains the same.

As a final comment, I also cannot see why the Sixer (HW29A) will not work with a vfo the same as the Twoer, since the circuit is basically the same.

. . .WB6FVW

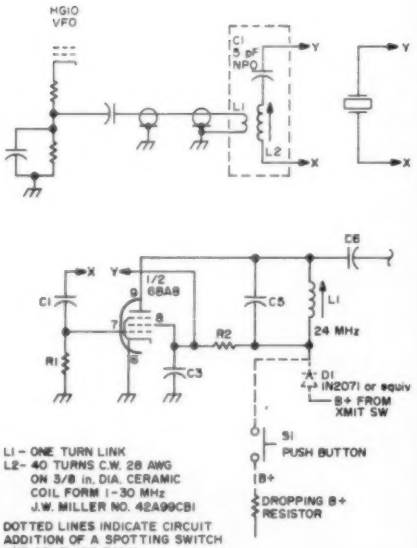


Fig. 1. MHz series tune tank.

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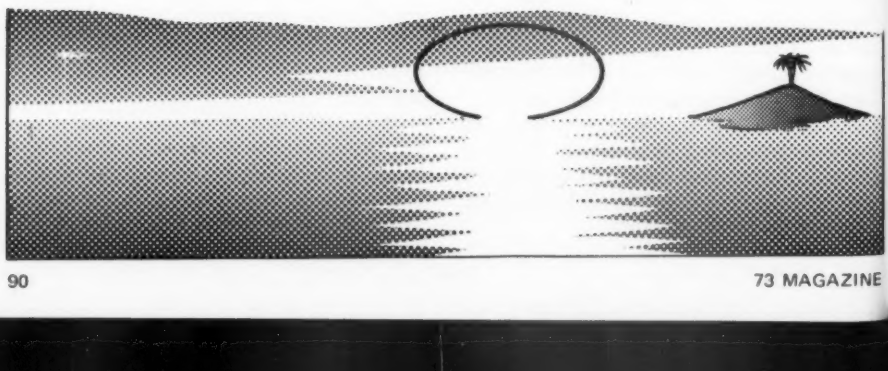

Al Shawsmith VK4SS
35 Whynot St., West End 4101
Queensland, Australia

/MM MANEUVERS

I'll bet you have a secret desire. Every man has his unspoken yearnings, be they paranoic dreams or just wishful thoughts. We all want, at some time or another, to escape from this crazy, phoney rat race or from some personal predicament.

Well, my craving is simple and virtuous. I'd like to sail a small ship and of course equip it with a good ham rig and go /mm. I've never dug deeply into myself to find the real reason, but for years this longing has persisted; it's common enough to many men. Maybe my ancestors were seafaring folk or perhaps it's that eternal situation that man forever creates for himself – a challenge. So whenever the emotion takes me I simply vacate the office and drive down to the city docks and spend rapturous hours watching the small craft come and go. Some from just across the bay, others from across the world.

You might say – "So what? Such a desire should be easy enough to satisfy. Use your spare cash and buy a boat." Yes, but there's one snag; I'm absolutely the worst sailor in the world. The wash from a rowboat is enough to send me to the rail to throw up. I can, if the weather's perfect and I'm dosed with sea sickness tablets, take a trip across the Tasman in a ship about the size of the Queen Mary. However, come the slighest swell and I'm like the proverbial Albatross who as soon as it lands on a vessel is immediately disoriented.

In fact I've been the object of medical investigation and discussion over my problem. At the City Hospital a panel of doctors examined me closely. How can anyone so apparently healthy get so violently sick and go so jelly-like so quickly at sea? Eventually a diagnosis was made and given a medical name. (Don't ask me to spell it, I can't even pronounce it.)

"It's an undue sensitivity, like an allergy, to movement or motion of a certain rhythm. Just keep both feet firmly planted on terra firma," was the professional opinion.

Now what sort of useless advice is that? It's like telling a man with diabetes to eat no sugar. The craving remains, so does the illness – and grows worse.

One day at the office I was having a chat with a psychologist friend of mine, and I told him of my passion for small boats, but that I was an armchair sailor, as they did terrible things to my innards.

"Maybe, but a suppressed desire is bad. In fact," he said, "deny it long enough and you're psychosomatic."

"I'm what?"

"Sick in the head – and all over."

"Really!"

"Yeah. That's what's wrong with half of us. We're too inhibited."

Was he, in a kind way, pointing the finger at me? It seemed I had more than a desire: I had a problem. The conversation was getting

out of my depth, so I was about to change the subject, when he said: "Take my advice and gratify your urge, OB. Try a trip somewhere; a little motion sickness won't kill you."

"Wanna bet?" I said, trying to make light of it.

The phone rang. It was the YF, Helen. "Al, you haven't forgotten that auction sale?"

"Oh, the auction – no, not at all, Honey," I lied. My spirits weren't particularly up. I'd drawn a blank with my last dozen clients and that puts any real estate man down. Auction sales are another form of challenge, but oh no, not today. I wasn't in the mood to face the piles of junk, the stale and musty smells, the odd-bods and general confusion in a big, dirty hall. But the voice on the phone persisted. The YF was not to be put off. It would have been easier to stay the tide.

"Now remember, it's the Oriental five--piece period sun room suite, No. 377 in the catalogue."

"Our sun room's OK," I said hopefully. My rig was set up in a corner of it, and I had no wish to be demoted to the bone-chilling den downstairs. But the YF, determined to carry out her house-proud scheme to every room, had decided to 'restore' it. The renovations would no doubt be artistically done, but my comfort would go in the process.

"Clare Jones and her friend from down the street are going, so see you out-bid them"

So that was it.

"Why aren't you there now? We'll miss out."

"All right Honey, I'll go along and look it over." I replaced the phone; argument would have been useless. My psychologist friend had taken his leave. Outside, the bright sunshine warmed a crisp, clear morning. What the heck was I doing sitting in this dingy, unheated office trying to make a fast buck?"

Delegating the business, such as it was, to my typist for an hour or so, I picked up my hat and headed for the car. "To hell with the auction sale," I mused. "I'll say the bidding was too high." Ahead of me there appeared an expanse of blue water and a flotilla of ships. Stimulated by the tang of salty air I sauntered out along a broad jetty, its rough planking bleached white by sun and flying sand. Thirty or forty small boats, commercial and private, were tied up and in them zestful activity raged. Some of the fraternity were scraping, painting and renovating; others loading and unloading.

A wide variety of odors, colors and sounds assailed and quickened my senses. Two blocks away roared a car-crammed asphalt jungle; here was a new and stimulating horizon. Adventure called.

Every man, they say, has his susceptibilities. Today, the wide expanse of blue water seemed irresistible. The vitality and gaiety of those who live in small ships is alien to the average inhibited city dweller. For the passing hour, at least, the business rat race was unsupportable. Oh, just to get away from it all. Not far north were palm-studded tropic isles, golden sands and an eternally warm sun. I was really letting myself go, mentally.

The sound of loud profanities reached my ears. From the cabin of a commercial type 40 ft cruiser, a voice was raised in frustration.

"The blasted thing was serviced on the last trip. Are you sure it won't 'G'?"

"Yep, Skipper, it's dead as that crate of mullet, aft."

"We're supposed to sail on the turn of the tide. Try the sunofabitch again."

The ship's name, I noticed was "GIDUP'NGO," but something inside wouldn't. Two men were bent over the radio gear. Poking my face through the Bridge window, I said, "Can I help?"

"Er, yep. If yer a radio man, come aboard." A swarthy, mahogany-tanned little man, in a skipper's cap, eyed me, for the moment, suspiciously.

"I'm Al Shawsmith."

"The name's Burns, and this is my mate, Eddie.'

I explained my qualifications. The Skipper waved a hand toward the equipment.

"Take a look – and there's a box of spares if you need something."

The rig proved to be a modern powerful one, with several fixed frequencies as well as GP coverage; also, the ham bands were

clearly marked. A flick of the on/off switch showed the prior blasphemies were justified. A couple of bumps with the palm of the hand on the Genemotor, and it moaned sickly. Further inspection showed a suspect connection in the circuitry. Soon it was humming musically and very much alive.

"It really needs a test out in the bay," I shouted above the auto and local QRN.

"OK – will do," said the Skipper, looking pleased, and motioning Eddie to the moor-ing ropes. ' Come for a spin?"

Apprehensively I gazed at the restless mass of open blue water.

"I'm a very bad sailor – really bad –," I began.

"What! On a day like this? Why, there's hardly a white horse to be seen."

Yes, it did seem too good to miss: the advice of my medical friend was still fresh in mind. "Right," I said, "Let's go."

The speed of GIDUP'NGO surprised me. There was no wallowing. She rode smooth and fast. As expected, the gear tested one hundred percent on all frequencies. It sure was a natty piece of equipment, and I decided to case the ham bands; something might be audible and this was an opportuni-ty too good to miss – reception being so much better at sea level. The only signal on 40 MHz was weak and unstable, but the call brought me to an instant alert.

"MAYDAY, MAYDAY, VK4 –– calling ––"

Could I believe my ears? Quickly I tuned the transmitter and replied on the frequency, with QRZ.

"Roger, Roger, Al, VK4SS. This is Harry VK4ZZZ. My car has crashed under Barron Bridge. Do you know my position – over?"

"Roger, VK4ZZZ. Your sigs are very weak, but I can copy. Yes, I know Barron Bridge. Are you injured – over?"

"Yes, my leg is jammed under the motor bulkhead. The transmitter power is failing and water is entering the floor – the tide. Please help urgently!"

The voice was strained with pain and shock. Skip Burns appeared at my side. "Was that a distress call?"

"Yes, a chap – a ham like myself – says he's under the Barron Bridge, in the river, and trapped in his car. He's hurt and the water is . . . "

"Yeah, the tide is on the turn. Hmmm, that's a colossal drop; must be eighty feet or more. Why hasn't someone seen him?" He paused and engaged me with direct question-ing eyes. "Could be phoney, huh? Check it out; call him again and see how long he's been there."

"VK4ZZZ de VK4SS. Harry, do you read? Please say when accident occured?"

"About two hours ago I guess. Didn't smash through bridge but was side-swiped by some speed maniac; missed viaduct approach and rolled down steep bank into thick scrub and mangroves. Guess no one can see me from above. Have been calling into this transceiver for nearly an hour. Can't see the mobile whip at rear. Think it's broken or maybe this deep gorge is blanketing the sigs. Was about to throw in the towel when I heard your QRZ. For God's sake get help if you can. Are you out at sea or in the vicinity? I seem to be OK except for my jammed foot . . . "

The signal disappeared into the hash. Mr. Burns gazed at the stippled haze of a mountain spur across many miles of open blue water. "Whaddya reckon." he queried.

"Well I'd say he was a ham right enough, but . . . "

"Anyway, we'll have to report it, no matter who he is. Tell him help is on the way."

"VK4ZZZ de VK4SS. Roger, Harry, we are in the area and will contact land base for immediate help. Please QSL?"

No reply, so I tried again, but only QRN crackled in the confined space of the cabin. I switched to crystal control and the shore base frequency and QSP'd the details of the situation and the message received. I turned to the Skipper for further orders. His steady gaze still searched the horizon. "How far is the Barron Bridge from the city – by road? What time would it take by car to res-cue––?"

"About three hours on the mountainous strip; that is, if they don't waste time with red tape. It's nearly a hundred miles from town and I can't recollect any nearby service station either."

Mr. Burns remained silent, evaluating the situation. Finally he said, "We can cut an

hour off that time. Anyway I couldn't let any poor bastard drown like that. Eddie, unlash the dinghy, stow it with rescue gear and make it ready for launching." The mate moved with sudden alacrity.

Long since have I been humbled by the whimsies of Fate. The circumstances of any life can change dramatically at any moment. An instant ago this was a pleasurable jaunt; now we were on a desperate dash to save a man's life. GIDUP'NGO was picking up speed and as we neared the open water I contemplated the crashing surf with abject horror. I had been through this before and knew of the consequences. "Oh for terra firma," I said to myself, and then felt guilty at the thought. Right now the rat race seemed less repulsive and the challenge of going to sea in small ships, much less romantic. All that was left was to put on a brave front. Already the landscape was beginning to spin and nausea cramped my midriff. I turned the receiver up in case VK4ZZZ should call again, and fell prone on the nearest bunk. Here the mate found me. "Hey, what's up?" he queried.

"Just queasy, I guess." How could I explain to a man of the sea my 'thing' about motion sickness.

He stood over me, his face a mixture of incredulity, pity and curiosity. "But we haven't hit the rough stuff, yet," he said. I must have looked bad, because he disappeared for a moment, and returned with a brown paper bag, which, of all odours, smelt of dead fish. Suddenly the boat began to pitch and roll, spray and blue water thudded against the porthole. The little ship fell into a trough between two rearing Pacific rollers, and at the same time, the bottom dropped right out of my stomach. I turned my face to the wall.

After what seemed an eternity, the drive of the power engine ceased, and GIDUP'NGO settled, and began to wallow. For some time, the ever-increasing sound of intermittent gunfire had been audible above the roar of the wind and sea, but I was too ill to question it. Now, sensing action was at hand, I struggled up from under a blanket of sea-sickness, and stood propped alongside the Captain at the wheel.

"Was that gunfire?" I asked.

"It was, and we have a problem. The Barron River forms one boundary of a restricted military area. The Army carries out manouevers here, from time to time. The rookies learn how to handle twenty-five pounders and other heavy stuff. All ships get prior notice. I should have remembered, but we don't have to actually enter the zone, only skirt it. If they keep to their range, we're safe."

"Could we call land base and request help from the Army," I suggested.

'Yep," the Skipper glanced at his watch. "It crossed my mind, too, but time is dead against it. We're behind schedule as it is."

GIDUP'NGO nosed slowly toward the river bar. The little craft rose and fell alarmingly in the steep and heavy sea. My mouth was hot and dry; also I had lost control over my knees and remained upright only because there was a stanchion handy for support. I realized that our moment of truth was at hand. Would she clear the bar? At that instant the sound of gunfire broke out again; so close now it percussed our ears. Shells struck the water with a whine and crump.

"Ignore it," commanded Mr. Burns, his eyes glued directly ahead. "We're still outside the official area." Like a plane at unstick speed we were now committed past the point of no return to negotiate the narrow channel. Suddenly there were two grinding and shuddering bumps.

"She's aground," yelled the mate. But GIDUP'NGO rose manfully again, backing up the next roller almost on her bowsprit. Then the deck seemed to explode under me and I was flat on my back in the scupper with the mate bellowing, "Skip, we've been hit. Holed in the port bow by those crazy bastards!"

At this point the world and I began to part company. Vaguely I remember something being dragged over my head – a Mae West. I was either dumped or fell into the dinghy; an oar was thrust in my hands and Mr. Burns was bawling, "Pull, for Christ's sake – ROW!" I made one desperate effort to obey before final oblivion brought blessed release.

. . . . . .

Consciousness returned rapidly (so I was told) as soon as they got me onto dry land. I had lain prone for over an hour, like a beached dugong in the bilge wash of the little dinghy while the Skipper and his mate strove valiantly to prise Harry from the crushed car. Suddenly the world around me reappeared as if from nowhere; there was a bedlam of noise, people shouting, car motors being started and the crunching of feet. The moment was the sweetest of my life; or so it seemed. No movement; I was lying on a stretcher on solid earth. The voice of Skip Burns was giving details to someone. "The other bloke's OK, just a busted ankle – lucky, huh. We're gonna take a lottery ticket on it, but this chap, well, I dunno. He just came along for the ride, to test the radio gear, but he's got a thing' about the sea, and passed out." Someone undid my soaked shirt and something cold was pressed against my chest; a stethescope.

"I'm OK, Doc," I mumbled.

"Yes, but you'd better go to hospital to see why you collapsed––"

A surge of irritation and shame passed through me, at my poor showing. "No," I said, a trifle piqued. "I'm going nowhere but home – but home."

"If you wish it, but I advise you to rest. You're still showing signs of stress." The doctor signaled the ambulance man.

On the trip back to town, the moments of truth, born in the crises when GIDUP'NGO was headed for Davey Jones' Locker, had time to sink in. My passion for life on the ocean wave and going /mm had vanished; it was useless pursuing the impossible. In a way I was grateful to my psychologist friend, whose advice had been to give it a go, and find out. To come to terms with one's self, is to be at peace. I'd be happily content in the shack from now on, even if I had to move it downstairs.

The ambulance drew to a halt. We were home, but my arrival was badly timed, to say the least. Two doors away, at the Joneses, a van was unloading the suite I was supposed to snap up at the morning's sales. The YF had been phoned so she was waiting – but HOW was she waiting. Human-like, I could have used a little sympathy or

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congratulations over the past happenings. But she stood like an untamed shrew at the head of the stairs, and who can be angrier than a jealous, deceived woman? Before I could open my mouth, she pitched right in.

"Yes, I know all about it. You sneak off to sea when you're supposed to stay put: what a drag you must have been. For one who can't even watch The Cruel Sea on TV without being sick, I must say you're game – or stupid."

How much does a man stand! It was time for my anger. "Look," I said, "quit raving. You're bugged because you lost out on a little odious game of oneupsmanship with the Joneses. My seamanship's got nothing to do with it. We all might have drowned, but all you can think of is your house-proud status. The sun room stays as is, with the rig in it." Feeling I had said enough I made for the bathroom to change and clean up. As I peeled off the wet duds a QSL card fell to the floor. It was Harry's, and on the back was scribbled "Salesman for contemporary and period furniture." Someone must have slipped it into my pocket while I was 'out.' So that was his line of business.

. . . . . .

Helen and I were dressing for a party; a special occasion. Six weeks had now passed since that fateful day. I say fateful, because Lady Luck seemed to have smiled on everyone as a consequence of the rescue.

The impasse between the YF and me over my use of the cosiest room in the house as a shack had been unexpectedly resolved. Harry phoned with a plea, that he be allowed to make me a little gift of some sort: or, was there something Helen could use in the home. What transpired between them, I'll never know, but I'm sure my ham friend is a diplomat as well as a furniture salesman. Yards of lush, rich drapes and carpets arrived for bedrooms and lounge. This was his "little" gift, and it set the YF to redecorating. The sun room was forgotten, and I was left in peace.

Harry presented me with his old mobile rig which worked perfectly, in spite of its dunking. His business firm had given him a new car, complete with a new rig, and to add to the lucky turn of events, between us we had landed a share prize in the city lottery.

Now here we were at an on-board, or ship-warming party to christen GIDUP'NGO 2. The sleek new 55 footer was a blaze of lights, and the small ships' fraternity was there in force. Skip Burns, a bottle of champagne in hand, and looking keen to pour the contents over someone at the first excuse, exchanged banter with all and sundry. Eddie, the mate, already three sheets to the wind, pitched and yawed among the guests; his duty, to keep the glasses full, including his own. Even landlubber Harry VK4ZZZ was there, showing off his plastered leg, and telling an audience how he was gargling the Pacific by the time Mr. Burns 'sprung' him from the car. Cuban Rum punch in hand, he kept the pace with the best of them, getting as high as the mainmast as he told of his lottery win with the Skipper.

A voice broke through the hubbub and salty slang – "Hey Burns, where didya pick up this pretty little packet? Piracy outside the 12 mile limit, or have ya got into the contraband racket?"

"Neither, Bud," The Skipper waved a sheaf of newspaper cuttings. "Haven't ya read all about it? The Army came good with compensation; collected some insurance, too. Then I raised the wind at the bank and Harry, Al and I had a win in the lottery. You'd heardly believe it, would ya?' He waved an arm around at the plush fittings – "So I bought GIDUP'NGO 2, all rigged, furnished, and set for deep sea fishing parties. Got it made, Eddie and me."

Someone suggested a spin. The mate unsteadily prepared to cast off. Those ropes were my umbilical cords to safety – land. I felt a trauma coming on, so it was time to leave. With good luck wishes all around, we waved good night. I knew the friendships made would remain.

Back at the car the YF said casually, "In a hurry to go home?"

"Not really. Why?"

"There s a real super study desk that would just suit the shack. It's on display downtown."

I smiled into the darkness. So the sun room was now my shack. My stint in the dog box was over.

. . .VK4SS

Osler H. Johns, Jr. W4ZBE
114 Rollins Street
Orlando FL 32804

The SUN and RADIO

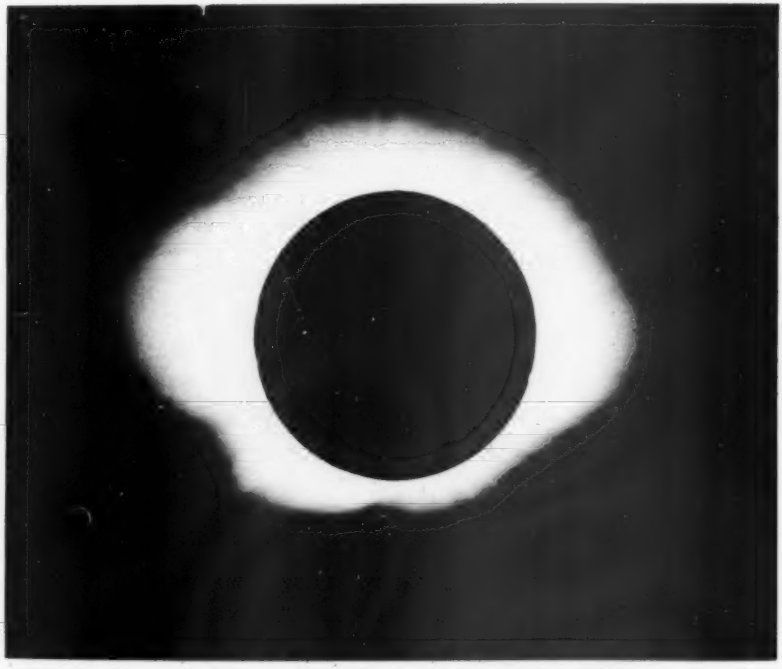
Prominences at the solar limb taken during the total eclipse of Aug. 31, 1932. The black sphere is the moon and the irregularities of the moon's surface can be seen in the photograph. Solar prominences usually occur in areas of high sunspot concentrations and between intense magnetic poles. (Lick Observatory photo.)

Such a statement may seem strange, but as we shall see the sun itself is one of the most important factors in radio communications from several aspects. The sun is a powerful radio transmitter, the cause of the ionosphere, source of magnetic storms and in general the most important factor to radio propagation.

Without the sun no ionosphere would exist and DX on 20 meters would be only slightly greater than that of VHF. As a source of radio noise the sun aids radio astronomers to understand the mechanics of the solar sphere. Whenever solar magnetic storms occur not only radio but landline telephone and telegraph communications are interrupted. The sun is the cause of charged particles being spewed out into space sometimes causing the aurora, an excellent source of VHF radio propagation.

The Sun Itself

Our sun is a very ordinary, middle-aged star. But to us it isn't so ordinary. It



The outer corona at the time of a total eclipse on Aug. 31, 1932 in Fryeburg, Maine. Without an eclipse or special instruments, the corona is not seen because of the bright light from the photosphere. The shape of the corona changes with the number and position of sunspots. (Lick Observatory photo.)

radiates some 5 billion horsepower per square mile on the earth and would take 100 earths placed side by side to make up its diameter.

If an observer in a neighbor galaxy were to look in the direction of our Milky Way all he would see would be millions of tiny specks of light, each one a separate sun. Among the specks would be one indistinguishable from all the others – our sun. Possibly, if viewed from another galaxy, our solar sphere and its nearest neighbor star group Alpha Centauri would not be distinguishable as separate objects they would appear so close. However, to give an illustration how far away Alpha Centauri really is, let us imagine that the earth and sun in a model are one foot apart. At this scale, the nearest star would be *fifty miles* away. The human mind can only quiver at the thought of such vastness.

This tiny speck in the universe is in reality 865,000 miles across and 93,000,000 miles removed from the earth.

When we observe the sun, we see a large yellow disk (and we never observe the sun with the naked eye or a telescope not equipped with a good solar filter), called the *photosphere.* The photosphere is the visible portion of the sun. It appears solid but in reality is gaseous like the rest of the sun. The photosphere has a temperature of 7,600 to 11,700°F.

Above the photosphere is the *chromosphere.* This layer, some 1000-2000 miles thick, reaches a temperature 20 times hotter than the surface. Normally the chromosphere cannot be seen because of the bright light coming from the photosphere. However, during eclipses of the sun and with special instruments the chromosphere may be observed.

An interesting note is that in 1895 helium was discovered in the chromosphere of the sun before the element was found on earth.

Prominences. Whole edge of sun taken with calcium K line, December 9, 1929. (Mount Wilson and Palomar Observatories.)

Later we shall delve deeper into the chromosphere because this layer has a tremendous effect on radio conditions at the earth.

American astronomers Harkness and Young first discovered the corona (which extends above the chromosphere) during an eclipse in 1869. This layer reaches outward several million miles above the photosphere, and sears at a temperature of one million degrees.

Where does the sun gain all its energy? Over the past 150 years numerous theories have been expounded stating that the sun's energy comes from combustion, electrical process, and gravitational contraction. None have proved satisfactory. During the last 50 years the nuclear fusion theory has become the standard explanation for solar energy.

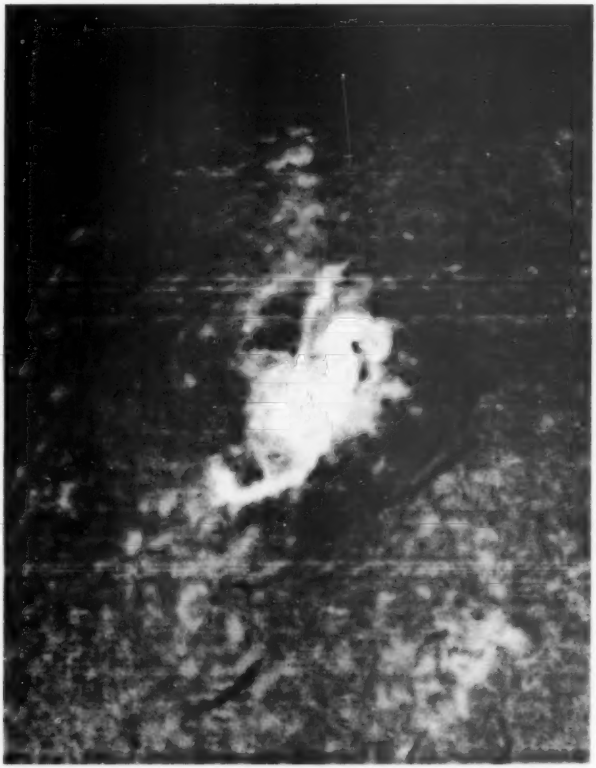
Energy comes from the fusing of four hydrogen atoms into two helium atoms. During the process two helium atoms weigh less than four hydrogen atoms. This extra mass is transformed into energy according to the famous equation derived by Albert Einstein and known to every junior high school science student: Energy is equal to the mass times the square of the velocity of light.

Naturally this process needs very special conditions to occur. The temperature must be at least 20 million degrees and the elements carbon and nitrogen are involved in the reactions.

Each star has a lifespan; like people, plants, and everything else, stars are born, grow, experience a middle age, grow old, and die. Each stage in the life of a star has its own special characteristics.

A star starts out as a large mass of hydrogen gas, very low in density but spread over an area about three lightyears across. Local concentrations or clumps of hydrogen form and, if the concentration is large enough, more and more hydrogen is attracted to these clumps by gravity.

This new star, termed a red giant, is relatively cold and gives off a reddish color. The pressure of the star's material clump-



SOLAR FLARE photographed in red light of the hydrogen a line. 1959 July 16. (Mount Wilson and Palomar Observatories.)

ing together causes the surface temperature to rise to about 1000°F. At the core the temperature might be a million degrees. The process is similar to a bicycle tire pump. When the air pressure in the pump's tube is increased by pressing the plunger, the temperature inside the tube becomes hotter.

After the star has been well formed, the temperature keeps rising. At birth the main source of energy was gravity, but then the temperature increases to the verge of nuclear reaction. This alternating between sources of energy is thought to cause the variability in brightness observed in some stars.

When the temperature reaches 20 million degrees, most of the star's energy comes from nuclear reactions. This is a fully grown star and where our own sun is now in its lifespan.

As the sun becomes older, it will become hotter and more luminous, until in a few billion years the earth will experience a temperature far greater than that at which life could exist. The oceans, rivers, lakes, and ice caps will boil away leaving only a scorched rock oribiting the sun.

After the sun's day of glory, it will become fainter and much smaller. It will be known as a "white dwarf" – very hot and very dense.

Finally the solar furnace will fade away, leaving the planets circling a cold, dark mass and the sky in that celestial vicinity will be as black as a moonless night forever.

The Sun and Radio Communications on Earth

The ionosphere exists because of the action of ultraviolet energy from the sun on the oxygen and nitrogen atoms in the upper atmosphere. The ultraviolet energy

Solar corona photographed at the total eclipse of June 8, 1918, Green River, Wyoming. (Mount Wilson and Palomar Observatories.)

frees the electrons from some atoms, causing a layer of ionized atoms and charged particles.

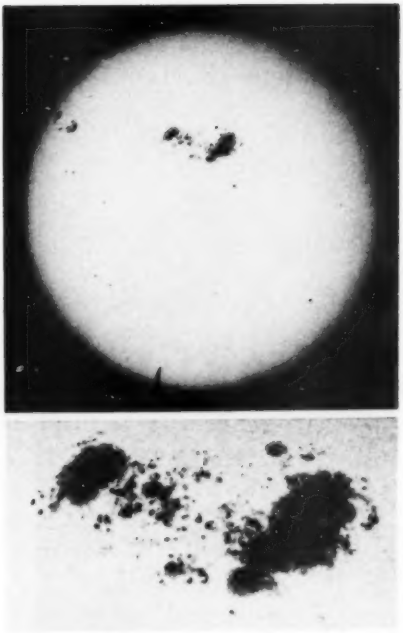
The ionosphere will reflect radio signals if only the right amount of ionization occurs. If the sun releases too much ultraviolet energy the ionosphere will have too many ions. When this happens our short-wave signal is exhausted in the interaction with large numbers of the charged particles.

The ionosphere is divided into several layers, the lowest of which is termed the *E layer*. The E layer forms at the maximum of 70 miles. At 70 miles the air is so dense that free electrons have only to move a short distance to recombine with another atom. Because of this ultraviolet energy must be present at all times to form the E layer. This means that the layer forms only during daylight with the highest concentration of ionization at noon.

During daylight hours, the *D layer* forms below the E layer. The D layer exists only during daylight and tends to absorb the daylight 80 and 40 meter signals. This is the reason distances on 80 and 40 meters are much less during the daytime hours.

The highest layer is the *F layer*, at an average of 175 miles. The air at this altitude is so thin that ions recombine slowly. At night, the ionization level slowly decreases, reaching minimum about 4 a.m. At night the F layer is one layer, however, in the daytime the F layer breaks into two parts (F1 and F2). The F1 is at a height of about 140 miles and the F2 is at 200 miles.

Sporadic E is another part of the iono-



sphere story. Sporadic E patches occur as dense clouds at approximately the same altitude as the E layer. These clouds may occur at most irregular intervals.

All of these layers of the ionosphere occur because of ultraviolet energy from the sun. During times of solar disturbances, sunspots, solar flares, and solar prominences the level of ionization tends to increase.

Heinrich Schwabe, a German businessman and amateur astronomer, in 1843 published his conclusion that sunspots tend to follow an 11-year cycle. Sunspots had been known for over 200 years since Galileo had first noticed their existence. Schwabe, however, first noticed the sunspot cycle.

At various times correlations have been attempted between sunspots and a variety of happenings on earth, from the price of wheat to the average jumping distance of the Australian kangaroo.

However, the sunspot *cycle* does have a definite effect on radio communications. During periods of maximum sunspots, the lowest frequency that an ionospheric layer will reflect is increased. Conversely, the frequency is lowered during minimum sunspots.

There has been a correlation between the number of sunspots and magnetic storms which disrupt the earth's magnetic field. Magnetic storms are most likely when large spots are near the sun's equator and last up to 4 days even after the spots have disappeared.

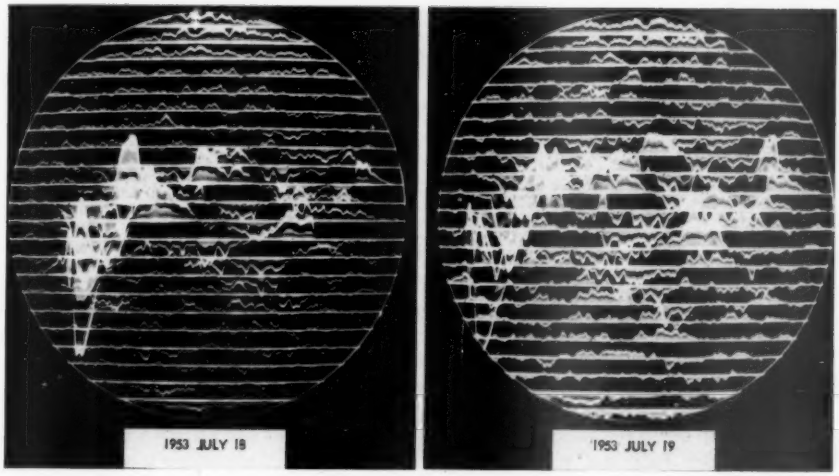
Sunspots cannot always be relied on for predicting magnetic storms. On November 13–14 1894 a large magnetic storm occurred but not a single sunspot was observed. Just the opposite occurred on December 17–20 1946 when no magnetic storm occurred but several huge sunspots moved into the right area of the sun to cause storms.

Sunspots exhibit one of the most powerful magnetic fields in the solar system. When a pair of spots appear a very strong polarity is set up. This field is much greater than anything maintained on earth and several times stronger than the sun's normal magnetic field. The sunspot itself is a mystery 350 years after Galileo's first observation. We know that the sunspot is actually an area that is about 3000°F cooler than the surrounding photosphere, but exactly why sunspots exist we do not know.

The sunspot only appears dark because it is cool in contrast to the hotter photosphere, however, if the sunspot were removed from the surface and put into space it would shine rather than appear black.

Sunspots occur at different positions on the sun during the cycle. During the beginning of a new cycle, most spots occur about 30 degrees north and south latitude on the sun's surface. Toward the end of the cycle most spots have come down to about 15 degrees of the equator. The last group of spots usually turn up at less than 10 degrees in latitude from the equator.

An interesting fact has arisen about the sun from the study of sunspots. The sun being gaseous doesn't revolve at the same rate on each latitutde.



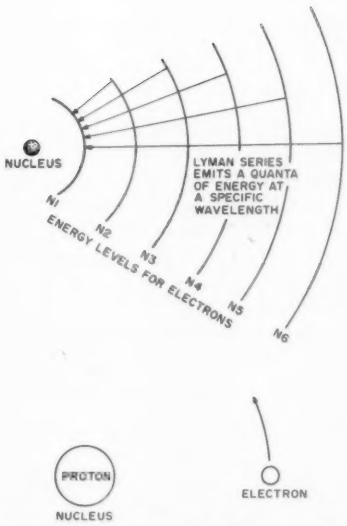
Emission of Ultraviolet Energy

Of great important in radio communications on earth is the emission of ultraviolet energy from the sun. Increases in ultraviolet emission occur at various times usually asssociated with large sunspots and solar flares and can cause communications difficulty. However, a constant level of ultraviolet radiation is needed to maintain the ionosphere.

Let us find out why the sun emits this ultraviolet energy.

The arrangement of hydrogen particles – one electron circling a nucleus – was first described by the Danish physicist Niels Bohr. Bohr's atom has since proved to be inaccurate, though we can use his familiar description of the atom as the nucleus being similar to the sun with the electrons being the planets.

Electrons do not always stay in the same orbit. For hydrogen, there are seven orbits, or "energy levels," in which the electron may be at any given time. Each



time an electron changes orbits a quanta of energy is either released or absorbed. If the electron falls to a lower orbit, energy is released; however, if the electron jumps to a higher orbit, energy of a specific wave-

length of energy is absorbed by the process.

One of these jumps is termed the *Lyman Series*. Only about one atom in a million in the solar atmosphere is excited to this state. However, this is enough to emit energy in the ultraviolet portion of the electromagnetic spectrum.

Along with sunspot cycles, solar prominences and solar flares influence terrestrial radio communication.

When a solar flare occurs, great quantities of ultraviolet energy are ejected into space. This causes radio signals to be absorbed or reflected erratically, destroying reliable communications.

During disturbances of the sun's surface, charged particles are often spread forth. These particles, upon reaching the earth, are channeled by the earth's magnetic field to one pole or the other, depending on the polarity of the pole and particle – thus producing the "aurora."

Every good VHF man knows that the aurora can be used for radio propagation just by pointing the antenna at the "curtain." However, good auroras tend to occur about two years after the sunspot maximum. Why? We don't know. Nobody does!

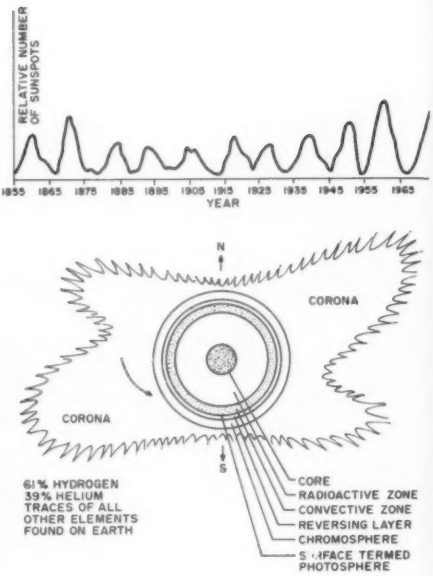
The Sun as a Radio Source

Radio waves make up a small part of the electromagnetic spectrum. The spectrum consits of radio waves, infrared, visibile light, ultraviolet, X-rays, and gamma rays. There is no distinct boundary between these forms; each fades from one form to the next.

The sun radiates all forms of energy along the electromagnetic spectrum. However, the sun itself – along with the earth's atmosphere and ionosphere – filter out most of the energy.

The quiet or undisturbed sun radiates with a constant signal level over several frequencies, originating from the chromosphere at temperatures between 10,000 and 40,000°K. Thermal stimulation of charged particles cause this radio radiation.

In the corona – several million degrees and several million miles out from the surface – is a strong source of radio radiation. This is one reason why the radio astronomer says that the "radio" sun is several times the "optical" sun in width.



The optical sun is very stable. We know this simply by observation. The sun doesn't appear to change in size or shape but the radio sun varies widely in size, shape, and intensity.

When the sun is disturbed, radio noise increases in signal level by a fantastic amount. At times, increases of a million-fold have been recorded. Radio noise seems to increase with solar surface phenomena such as flares, prominences, or sunspots. When large sunspots appear, radio noise can be detected several days before the spot appears and several days after the spot has disappeared.

We often take the sun for granted, little realizing that it is the master of our solar system. It is so massive that it makes our small planet look microscopic. Yet compared with the universe, the sun is so small that the English language has no words to express its small size. Truly, its proportions defy description, be they considered relatively as massive or minuscule. Yet none could deny the gargantuan effect of our tiny giant on earthly communications.

. . .Johns■

Bill Garfield WB9FOP
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POOR MAN'S TRANSCANNER

Being an active FM'er, already the proud owner of a Regency HR-2 that was chock full of crystals, you might say I felt as though I were in FM heaven. And I was, until that day in September when I spotted the new Regency Transcanner at the Cincy stagfest. Wow, what a rig! With all the frequencies in use back home, I could sure put one of those to work. Hardly a day goes by that I don't miss a call or two, just because I m listening to the wrong frequency.

Like the rest of you probably, I sure didn't have the $300+ necessary to buy such a rig. What was worse, I couldn't even find anyone who would make a decent offer for my HR-2. It seems at a hamfest everyone wants something for nothing. Anyway, I spent the fifty hard-earned bucks I had with me for some useless knickknacks and left for home.

A few months later, still dreaming of the "super-rig," a friend of mine came to the house to show me his latest plaything. A Regency TMR-8H high band scanner. I thought to myself, "Now isn't this just what this knothead needs – a super-glorified, light-flashing, CB'er's delight fuzz monitor." It wasn't until some time after he left that I started thinking, "Wonder if one of those would work on two meters?"

The next evening after work I dashed to the local CB establishment and asked the guy at the counter to "Lemmesee one-a those' instruction books for one-a dem scanners." The fellow was a little apprehensive at first, but I managed to get it across to him that I had a particular idea in mind, and I wanted to see if this gadget would work. He consented. My hopes were well-founded. The Regency TMR-8H *would* work – perfectly. I handed the guy a check

for the purchase price (slightly greater than one-third the cost of the "super rig" I had dreamed about) and headed for home.

Inside the house I declared the kitchen table a disaster area and scooted the XYL into the boob-tube room. Next came the scrounging of tools and leftover parts from past projects. I took a seat amidst the chaos.

I hurriedly removed the cabinets from both rigs, and began transferring the receive crystals from my HR-2 over to my new Scanner. Then the big moment – the little telescoping antenna in place, the ac cord plugged in, and the power on. IT WORKS! That's Doc working Woody through the seven-six machine twenty miles from here. Not bad!

The sensitivity needed a little improvement though. I instructed the XYL to touch nothing on the table and headed for the local Motorola repair shop. The fellow there is a ham, too, so a quick realignment of a couple of front-end slugs was obtained easily enough. "Gee, sure was way off," I said meekly. "Let's see how the thing checks out now . . . not bad. An easy 0.3 μV for a good 20 dB of quieting. See you later, and thanks!"

The next step was to provide for muting and antenna changeover. No problem at all. The HR-2 antenna lead is already switched by the T/R relay, and looky there . . . an extra set of SPDT contacts that will handle the muting job perfectly. This must really be my day.

In an effort to make a long story short, we'll take up from here with the meat of the conversion information, without all my conjectures.

Start on the HR-2: Disconnect and remove the speaker completely, leads and all. It will no longer be needed. Next, unsolder and remove the little ground lug from terminal 4 on the external speaker block. Add a 3 to 5Ω 2W resistor between terminal 1 and the nearest ground. The chassis will do nicely. Now remove the external speaker jumper from terminals 1 and 2. Carefully drill a ¼ in. hole in the back plate, between the power plug and the speaker terminal board. Mount an RCA type phono jack here. Carefully remove the relay cover and observe the swjtching arrangement of the SPDT spare contacts. Connect the normally open spare contact to terminal 4 of the external speaker block. Connect the normally closed contact to terminal 2, and the relay tongue to terminal 3. Remove the 10.245 MHz i-f crystal and put it aside for safekeeping. It won't be needed, and may cause problems if left in. Unsolder the coax from the receiver rf deck and reconnect it to the phono jack installed earlier. This completes modifications to your HR-2.

On the Scanner, temporarily remove the speaker, leaving the wires intact. Add a 3 to 5Ω 2W resistor between speaker terminal strip lugs 3 and 4 (ground). Remove the external jumper from terminals 1 and 2. This completes modifications of the Scanner.

Assemble a short coax jumper with a male RCA phono plug on one end, and a male car-radio antenna plug (Cinch #13B or H.H. Smith #1200) on the other. This jumper will be used to connect the antenna switched by the T/R relay of the HR-2 to the Scanner. Using stranded hook-up wire, connect the following terminals together:

Scanner Terminal	to	HR-2 Terminal
1	"	3
2	"	2
3	"	4

That's all! Now hop in the car, install the two rigs, and have a ball. You may want to connect your HR-2 power cord to a switched position on your car's fuseblock, and the Scanner to an un-switched position. That way, you or anyone else can listen, but transmitting can only take place when the key is in the ignition.

You'll have a little getting-used-to-it to do, as you've gained a few knobs and switches. Don't forget to synchronize the transmitter with the channel you're being called on. Otherwise you may find yourself answering a guy on 82 when he is calling you on 94. Don't feel too bad if you do, though. I still do it occasionally.

. . .WB9FOP

Ed. Note – Since many other transceivers have extra relay contacts, similar modifications can be made. If trade-in value is on your mind, this modification is easily undone.

Ron Sebol W3HXO
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FOR KILOWATT POWER SUPPLIES

One evening when John (K3SGB) and I were talking about our luck in collecting parts for our linear amplifier projects, the conversation eventually turned to the power supply section. We considered the merits of both choke input supplies and capacitor input supplies and found both kinds lacking in one or more ways. For a given capacitor value, the capacitor input supply had more ripple than a choke input supply using the same or even smaller value of capacitance. In addition, the capacitor input supply had a starting current surge problem and poorer voltage stability.

For example, in a 2.5 kV supply, it is common to see 500V variations and extremely heavy starting surges. On the other hand, a choke input supply requires very high bleeder current to obtain the full voltage stability the supply is capable of. Even with a swinging choke, critical current bleeders can waste hundreds of watts. Since John and I wanted to use intermittent-voice-service rated transformers, fixed chokes of about 4H, and a filter capacitance of about 10 μF, we decided to give some thought to voltage regulators because a simple supply represented too many compromises. We soon realized that a regulator would not only eliminate the need for some of the design compromises, but that it would solve the problem of how to reduce the supply voltage during testing, tuneup, and other instances of reduced-power operation. For this purpose a Variac is usually used, but it does not solve any of the other design problems and it would cost as much as a regulator. What was needed, we decided, was a regulator which would allow us to vary the power supply output from a few hundred volts to several thousand volts, while providing excellent regulation and high operating efficiency. With these thoughts in mind I went to work and about one week later had a regulator which satisfied our goals with wide margins.

Since the type of regulator which was built is one which is rarely seen, even in commercial equipment, I have emphasized the manner in which it works rather than the manner in which it was built. This regulator is unusual because it operates on

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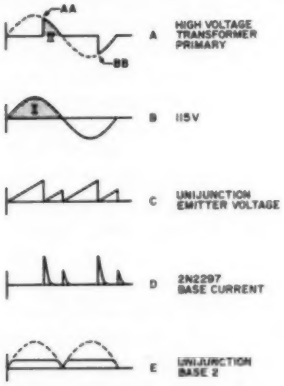

Fig. 1. Pertinent waveforms.

the primary side of the high voltage supply power transformer and manipulates the waveform which is applied to the transformer.

When a voltage such as the one shown in Fig. 1A is applied to the primary of the power transformer, instead of the sine wave shown by the dotted line, less dc voltage will be produced by the supply. This is an important point so let's see what makes it so. In a capacitor input filter, the capacitor charges toward the peak voltage produced by the rectifier diodes. Since the peak voltage of the waveform shown in Fig. 1A is less than the peak voltage of the dotted sine wave, the capacitor input supply output will be less.

In the choke input supply, the dc output voltage is more closely related to the average value (which is proportional to the area) of the rectifier waveform than to its peak voltage. If you look at the area marked II in Fig. 1A, you will see that it is smaller than the area marked I in Fig. 1B. Hence, in both types of supply, less voltage will be produced by the partial sine wave than by the full.

How do you produce this waveform? Equally important, how do you cause the points marked AA and BB to move automatically to the left when the supply voltage is too low and to move to the right when the supply voltage is too high? The answer is that you place an SCR in series with the 115V line and the transformer primary. In this circuit, the SCR behaves somewhat like a single-pole switch. The SCR switch "closes" when it is triggered and "opens" when the voltage across it becomes too small or reverses in polarity. This switch-like behavior of the SCR explains the peculiar appearance of the waveform in Fig. 1A, the voltage at the transformer side of the SCR. Due to the high currents which have to be switched, several SCRs have been paralleled. Figure 2 shows where the SCR bank fits into the circuit. Now let's see how the SCR trigger pulses are generated.

The SCR bank is shown in detail in Fig. 3. In it, the various SCR trigger pulses have to meet several different requirements. The more obvious of these is that the amplitude and duration of the pulses have to be tailored to the individual requirements of the six prime SCRs. Secondly, since these SCRs are combined into a bank, their individual requirements will translate into a combined trigger requirement for the bank. In turn, this will, as you shall see, intro-

duce a need for two additional SCRs which serve as triggers for the others. In turn again, the triggering units will have triggering requirements of their own. Finally, and most important, the trigger pulses must occur at the correct time in each half-cycle of the 60 Hz power line. Let's first consider the timing problem and then turn to the lesser trigger requirements.

In Fig. 4, above the capacitor marked "timing capacitor," there is a PNP transistor. This transistor is part of the section of the regulator which translates a control

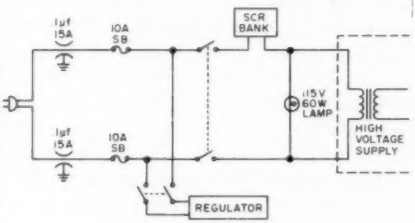

Fig. 2. Ac line connections.

voltage into proportional time delays. In particular, the PNP transistor acts as a variable source of constant current. This is not self-contradictory; the collector current is constant with respect to the collector voltage of the transistor, not its base voltage.

Since a transistor has current gain, a small base current can produce a large emitter current. Consequently, the voltage established by the resistor divider at the base of the PNP is not changed much by the small amount of base current which flows. The emitter and base potentials of a silicon transistor differ by only 0.6V so we find that the emitter voltage is very nearly the voltage which the resistor divider at the PNP base would produce if no transistor were attached to it. This behavior causes the emitter current to be determined by a base voltage, since the emitter load is a resistor whose other end is attached to a fixed B+ supply.

Finally, since the PNP collector current is almost equal to the emitter current, it too will be determined by the base voltage (as long as the collector voltage remains more negative than the emitter voltage). If no other components were present, the timing capacitor would charge constantly until its voltage reached that of the PNP emitter and then it would remain at the emitter potential indefinitely. This brings us to the 2N2646, a unijunction transistor.

The unijunction transistor, like the SCR, is also a switch of sorts. However, the conditions which cause it to switch are different from those in an SCR. Unlike an SCR, which switches when sufficient *current* flows from gate to cathode, a unijunction transistor switches when its emitter *voltage* becomes approximately 60% of the voltage at base two. When a unijunction transistor switches, the resistance between its emitter and base one terminals changes suddenly from tens of megohms to a few hundred ohms. Since the base two voltage, in this particular circuit, is never more than 4.0V, the timing capacitor is never allowed

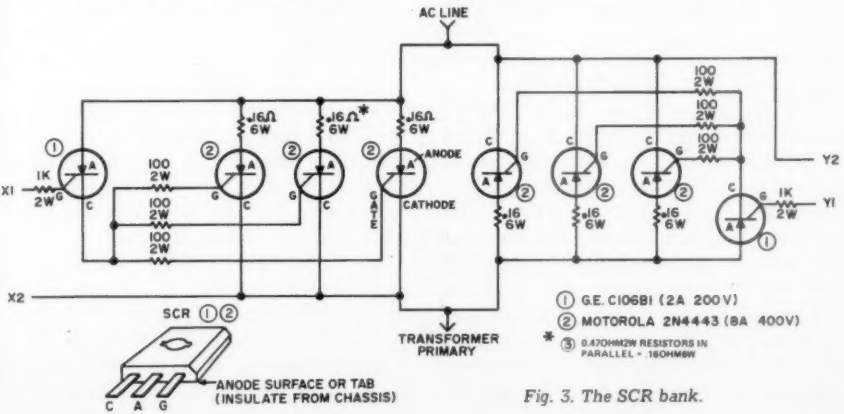

Fig. 3. The SCR bank.

to charge until it reaches the PNP emitter potential because the unijunction transistor will always switch and discharge the timing capacitor to ground first.

Once the "switch" closes, it will remain closed until the current flowing through it falls below a critical value, called the "holding current." The value of the PNP emitter resistor was chosen so that the collector current of the PNP would always be less than the unijunction transistor holding current, thereby insuring the turn-off of the unijunction transistor after the discharge of the timing capacitor. Therefore, if we start following the action at the timing capacitor, a little while after the unijunction transistor has turned off, we will see the voltage rising linearly for a while and then suddenly dropping to very nearly ground. This can be seen in Fig. 1C.

The charge stored in the timing capacitor is dumped in a few microseconds; during the dump, a current of tens of milliamperes flows into the base of the 2N2297 transistor from the timing capacitor, via the unijunction transistor. The 2N2297 further amplifies the capacitor dump current and drives the primary of a 5 μs pulse transformer. The secondaries of the pulse transformer, X1-X2 and Y1-Y2 of Fig. 4, both produce 25V SCR trigger pulses of about 5 μs duration. The emitter current waveform of the unijunction transistor can be seen in Fig. 1D. The smaller ramps and current pulses which you see in the two figures will be explained later.

As you probably have guessed, all of this switching cannot take place without some sort of relation to the ac line. All of the waveforms in Fig. 1A through 1E do, in fact, show just such a relationship.

The manner in which the unijunction switching is synchronized to the ac line is shown best in Fig. 1E. This waveform is the voltage which exists at the base two terminal of the unijunction transistor. This voltage is obtained by full-wave rectifying the 24V transformer and clipping the result with a 4V zener. Remember that the unijunction switches when its emitter voltage is 60% of the voltage at base two. Since the base two waveform becomes zero every time the ac line goes through zero, the unijunction transistor is forced to switch at the zero crossing of each half line-cycle. As a result, the timing capacitor will always have a new voltage ramp beginning at the zero crossings of the line. (If the timing capacitor is charged rapidly enough, the unijunction transistor can be caused to switch more than once during each half line-cycle. This explains the presence of the smaller ramps and current pulses mentioned before.) Since the SCR bank is turned on by the first capacitor dump after a zero crossing of the ac line, the secondary ramps will have no effect and are not important. Now let's get back to Fig. 3 and see what the rest of the SCR story is.

At 2 kW, assuming a power transformer efficiency of 80%, over 21A must be drawn from the ac line. Since an SCR operates in only one direction, there are two of them required, one for each polarity of the half line-cycles. Therefore, each SCR only needs to be rated at half this value (about 10A). This would still provide about a 2-to-1 safety factor because a normal voice waveform has about a 0.5 duty factor. To be extra safe, an SCR rated at 15A should be used.

As for its voltage, 400V gives a good safety factor with respect to the peak voltage of the power line. Rather than buy a pair of new units I used some 8A units which happened to be on hand. As you can see, I hedged the safety factors even more. The bank is equivalent to a pair of 24A, 400V units. The 0.16Ω resistors in series with each 2N4443 SCR insures equal division of the load current. These resistors must not be omitted in parallel operation if a lower current type of SCR is employed.

Due to the leakage reactance of the power transformer, the current drawn from the SCR bank during the 5 μs trigger interval is quite small. Another type of SCR, a C106B1, with a holding current of only 1 mA, is used to get the bank started. The 100Ω resistors attached to each 2N4443 gate lead equalize the gate currents so that each SCR in the bank gets an equal share of the triggering current. The 1 kΩ resistors, connected to the gates of the C106B1 triggering SCRs, prevent the load which is reflected back to the pulse trans-

former primary from becoming too large.

In order to further insure turn-on of the SCR bank, a resistive load was placed in parallel with the primary winding of the power transformer. It was found that a 60W light bulb worked quite well as the resistive load. Without the resistive load the SCR bank would not always behave properly, especially when the high voltage supply was only loaded lightly.

To review, a constant current source, a timing capacitor, a unijunction transistor, and a 2N2297 generate SCR trigger pulses once per half line-cycle. Earlier, it was stated that the supply output could be varied by causing points AA and BB (Fig. 1A) to move to the right or left. More precisely, the time which elapses between a line voltage zero crossing and the first trigger pulse to follow, will determine the supply output voltage. This time delay is inversely proportional to the magnitude of the constant current produced by the PNP transistor. That is, to make the time delay half as large, double the constant current. Since the charging rate of the timing capacitor is controlled, indirectly, by the base voltage of the PNP transistor, we must consider the manner in which this voltage is varied. This brings us to the next major section of the regulator circuit, the IC differential amplifier.

Externally, the differential amplifier looks somewhat like a conventional transistor, except for its additional leads. Electrically, there is a vast difference. Within its metal can there are over a dozen transistors and as many more resistors, connected together to form an entire circuit. In short, it is an integrated circuit. Specifically, it is a differential amplifier. A differential amplifier, by definition, has an output voltage which is proportional to the *difference* of two input voltages, rather than to the voltages themselves. In the National Semiconductor LM201, the kind which was used, the output voltage is typically 25,000 times the difference of the input voltages. In this circuit, one side of the amplifier input is connected to ground via a 1 kΩ resistor. The other amplifier input is connected to a minus voltage reference and the positive voltage output of the high voltage supply. The resistor values have been chosen so that by varying the potentiometer, marked "voltage adjust" (Fig. 4) the supply output can be varied from less than 100V to over 3.5 kV. If the input of the amplifier, at which the minus reference and the positive output voltage are combined, differs from ground potential by even a few millivolts then the amplifier will produce several volts of corrective action at its output.

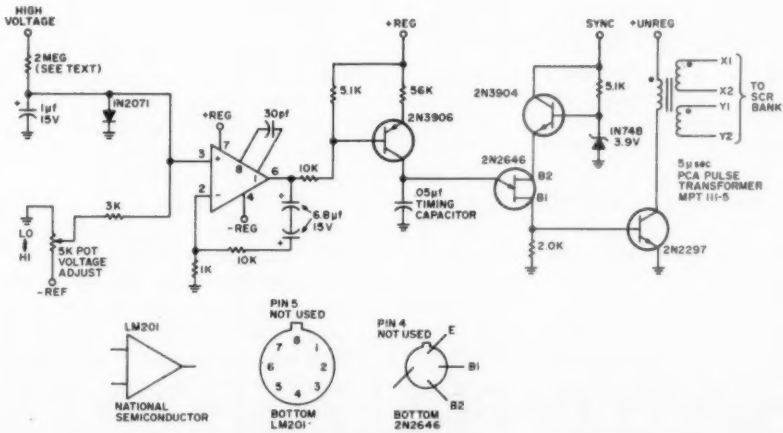

Fig. 4. Error amplifier and trigger generator.

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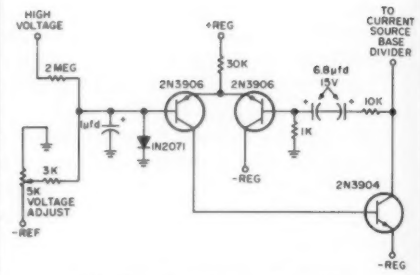

Fig. 5. Cheaper differential amplifier.

This particular differential amplifier costs about $13, a price which some of you may prefer not to pay. This amplifier is so good that it almost overkills the problem. Since the regulator circuit will work with other amplifiers, you may want to try a cheaper unit just to get the regulator on the air. There are many fine IC amplifiers available at less cost; if you use another type be sure to get the data sheet for it from its manufacturer. Follow the manufacturer's recommendations or you will probably end up with an oscillator instead of an amplifier.

If you would prefer to build your own amplifier, you can try the one shown in Fig. 5. It should cost less than $2 even if you buy all of the parts new. I did not try the cheaper amplifier so it may not be completely compatible. If any tweaking of values is required, the parts which are most likely to need the tweaking are the 6.8 μF feedback capacitors and the 10 kΩ resistor in series with them.

I have used the three-transistor amplifier in other circuits and found that it usually has a gain of 300.

With a constant load on the supply, you should see a voltage of nearly zero at pin 2 of the differential amplifier. You may wonder why this pin is not simply grounded. The reason is that the speed of response of the amplifier must be reduced. Due to the high gain of the amplifier and also the fact that only one corrective decision can be made in any given half line-cycle, the regulator would hunt around for the correct voltage without ever finding it. During one half line-cycle the regulator

would produce a minimum time delay and in the very next one it would produce a maximum delay. The three components which are connected to terminal 2 of the amplifier prevent the overcorrections from occurring.

Finally, we get to the regulator power supply. There is nothing unusual about it aside from the fact that one of its outputs is an unfiltered full-wave rectified sine wave. Zener diodes and emitter followers provide a regulated B+ and two regulated B– voltages. The complete power supply circuit is shown in Fig. 6.

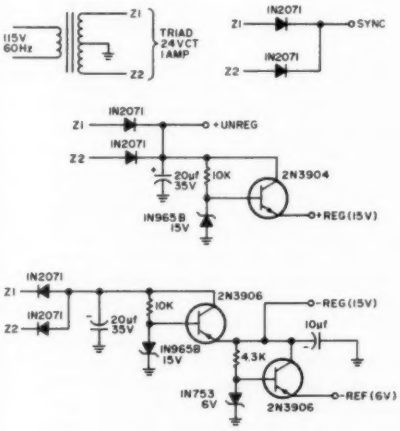

Fig. 6. Regulator power supply.

There is not a great deal to be said about construction of this circuit, because there are no hidden traps awaiting you. Obviously, with a very high gain amplifier you should keep the lead lengths at its input short. Also, since large currents are being switched, you should use sufficiently heavy wire, fuses, switches, etc. Finally, again because currents are being switched, you should enclose the circuit and not omit the 0.1 μF line filter capacitors. The unit I built was contained in a 2 x 5 x 7 in. chassis and the regulator circuit was placed on a 3 x 3 in. printed circuit.

One more caution: Use ten 200 kΩ resistors in series, rather than a single 2 MΩ resistor, in the return from the supply output to the amplifier input, in order to stay well within the resistor manufacturer's maximum voltage and power ratings. The 2W size is fine.

Now I am sure you will want to know how well the regulator circuit works. To test it, I borrowed a Heath model HP-24 kilowatt power supply. This is a capacitor input filter supply which has a no-load output of 2.5 kV. A knife-switch-controlled dummy load, which drew 600W from the supply, was assembled. (For safety, the knife switch was operated with a 1 ft wooden dowel.) Without the regulator, the supply dropped from 2.5 to 1.9 kV when the load was switched in. With the regulator, the supply was set at various voltages below 1.9 kV with no load. After the load was switched in, there was no net voltage change discernible – not even one meter pointer's width! I checked the transient response at a 1.9 kV setting scope and found that the supply voltage dropped 80V when the load switch was first closed. One half line-cycle later, the voltage had recovered 40V out of the 80V, and during the next half line-cycle, the remainder was recovered. I had no way to test the supply with voice modulation; however, I think that the 600W test was severe enough to be representative. As a guess, I would expect to see about ±50V variations with the Heath supply and voice loading.

The switching hash level was checked with a receiver which was plugged into the same line as the regulator. With no line filtering, there was no hash on the bands above 40 meters and the hash was only about S7 on 40 meters. On 80 meters it was quite loud. If you use the 0.1 μF line filters and keep the rest of the circuit in a small chassis, you should not have any hash problem on any band.

As a final check, a 14A electric heater was used as a load and the regulator was run for 15 minutes. After the 15 minute trial, nothing was more than lukewarm, except the electric heater.

If you do decide to try building this regulator, don't make it your last project – 3000V power supplies are dangerous!

... W3HXO ■

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Bill Hoisington K1CLL
Far Over Farm
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THE 1296'er: IDEAL CRYSTAL OSCILLATOR

This details the design of a crystal-controlled oscillator especially designed for 1296 multiplier service, and begins a series on the construction of a complete solid state low-cost rig for 1296 MHz. With transistors that work well in the 2400 MHz band, 1296 should be easy. Well, it isn't all that easy, but with a little care for detail it can be done. A large part of the receiver starting from and including the 28 to 30 MHz tuneable i-f section, through the 1.65 i-f, the 135 kHz i-f, and the audio, all using IC's (integrated circuits) has or will be detailed in articles in 73 Magazine. All you need to complete the receiver is the converter and one or two low noise stages on 1296, and these will be described later on.

We will go into this 1296 in easy stages, with an "Ideal" crystal oscillator first.

Towards An Ideal Crystal Oscillator

This just happens to be the best crystal oscillator I've ever made. Actually it didn't just happen. I worked hard on it. We're going up to 1296 so we need all the "sock" we can get and still have a good, reliable, stable oscillator. This one has the punch – 168 mW rf output at last measurement, it stays right in the pass-band of my lab receiver, comes on the air every time the switch is thrown, and uses the Motorola HEP 55 transistor (only $1.20). This is my Universal Device, which seems to be good for almost any stage anywhere.

This oscillator works with full power on all the crystals I have around in the shack from 45 to 54 MHz, and is the result of over thirty years of working with control crystals. Off and on I should say, and for the last ten years with greater and greater emphasis on transistor units. And the last few days full time to bring you a low-cost excellent design. If it isn't the ideal, it's awfully close!

How It Works

Referring to Fig. 1, NPN Q1 is turned on by supplying positive voltage to the collector and base, causing current to flow. Turn on current and "graininess" in the collector current of L1 is fed back to the base circuit through the control crystal, which reverses the phase (see detail below). Q1 amplifies these minute pulses which in turn resonate in the L1,C1 circuit, and the oscillator takes off, on the crystal frequency only, however. A piezoelectric crystal such as quartz operates by means of compression and extension waves in the crystal. These are also known as sound waves. They are in the form of maximized standing waves which bounce back and forth between two crystal surfaces (outer

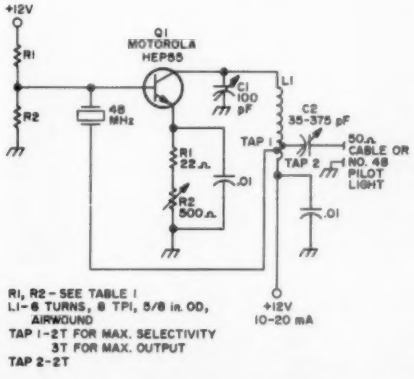


Fig. 1. Ideal crystal oscillator.

wall, or air surfaces) which furnish a high degree of reflection. At one part of the cycle (48 million per second in this case) one side of the crystal is positive and the other negative. The next half cycle, the polarities are reversed under the influence of the ac voltage. Also in this case there is more than one cycle through the cyrstal thickness, but as long as there are an odd number of half waves (sound waves) it will work. This basic action of control crystals thus causes a 180 degree (or nearly that amount) phase reversal from one side to the other, the feedback path from the collector coil L1, which started out *in* phase, reaches the base *out* of phase, which is the proper condition to cause oscillation.

Power can be adjusted by the emitter pot R2, and a fairly good output match can be obtained with tap 2 and C2. Good luck.

Base Bias

This was quite a revelation. I found that almost any combination of R1 and R2 could be used as long as the voltage was right, and this was not critical, except for pushing maximum power out. Table 1 shows representative values for R1 and R2 that resulted from the test runs on this parameter. There appears little difference in power output so you can use any of the values shown. I generally slap in a 5K and a 1K and that's it.

Emitter Bias

This is not in the least critical either. Smooth control of the current and the output rf power is found with R2, varying from 160 mW down to less than 10 mW. And that's it for bias.

Crystals

Using the finished circuit of Fig. 1, four crystals on 48 or 48.1 MHz were tested. A ¾ in. square one was excellent, and three in the small case size ½ in. long by 3/8 in. wide worked just as well with full power out.

Note that the circuit is using quite a lot of feedback, with good output loading also. This can be desirable for multiplier service which we are building here, but if you don't need maximum output you can drop both Tap 1 and Tap 2 down on the coil towards the cold end.

Table I

R1	R2
5K	1K
10K	2K
25K	5K
35K	10K

The Inductance

Several coils were tried in the L1 position, as you may not have some of those air-wound jobs on hand, or you might want to save space and use smaller coils. Coil B gave the same output of 160 mW of rf, the same as coil A, as far as I could determine, which is about plus or minus 5 mW, but did not tune quite as smooth as I would have liked. It had a tendency to jump a little in power as R2 was turned down.

Coil C behaved exactly like coil A, so use C instead of B for smaller size work. The Q of a small size oscillator coil in the maximum load condition is evidently not very different than that of a larger coil.

Feedback tap. This is not too critical, but it should be positioned for the results needed. The ratio of turns from Tap 1 to the cold end, to the number of turns from Tap 1 to the high end is about one to three, as you can see in Fig. 1. This is for maximum output. For maximum selectivity and sharper tuning a slightly larger ratio, with the tap nearer the cold end, is preferable.

Plenty of feedback (lower ratio) is probably best for driving a tripler, which likes a lot of harmonic content.

Output tap No. 2. This is mainly a question of loading and matching, and the series output capacity C2 plays an important part here. A good match to a No. 48 test bulb for milliwatt determination can be obtained with between 50 and 100 pF. For a 50Ω cable, more capacity may be needed.

An excellent crystal controlled oscillator for tripler driving has been described in detail, which should start you off on the way toward an interesting solid state 1296 MHz rig. . . . K1CLL■

Jim Reichler WN2REW
P.O. Box 153
Stony Brook NY 11790

FOR FRUSTRATED NOVICES:

Listening to 'Phone with the HW-16

The Heathkit HW-16 transceiver is a fine, inexpensive rig for CW, and for this reason many Novices use it. Its excellent selectivity (500 Hz) makes copying CW easy and pleasurable.

However, it is a rare Novice who doesn't get bored occasionally with code and would prefer to listen on the phone bands for awhile. It is here that the good selectivity of the HW-16 works against the Novice. The rig's narrow bandspread makes copying SSB or AM nearly impossible.

Since the HW-16 covers a portion of the 40 meter phone band, decreasing the rig's selectivity would allow the Novice operator to listen to the goings-on on this phone band. Happily a simple modification is all that is needed to provide this decrease in selectivity whenever the operator desires it.

The switch can be placed on the rig as shown or in any other convenient location.

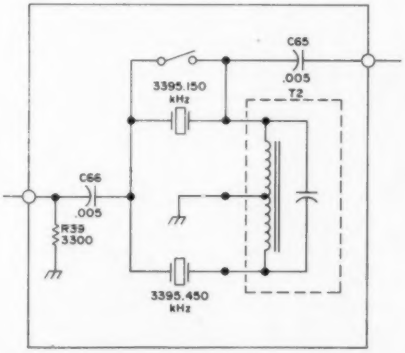
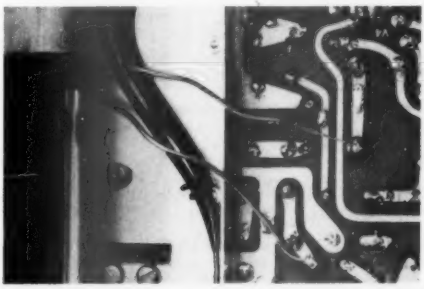


Fig. 1. The new switch runs from C65 to C66, in parallel with the upper crystal.



The lead wires can be soldered to the circuit board and run up to the switch through the opening in the chassis for the tuning dial.

As can be seen in the accompanying schematic (Fig. 1), capacitors C65 and C66

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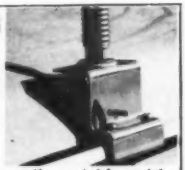

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on the receiver circuit board are connected through an SPST switch. When the switch is closed, this new circuit decreases the effectiveness of the crystal filter enough to allow perfect copy of SSB and AM signals. When the switch is open the original CW selectivity is not affected.

The new switch can be mounted on the front panel of the HW-16 as shown.

There are other uses, "byproducts," of this modification. It can be used in the CW bands to scan a much larger portion of the band than would ordinarily be possible with the rig's normal selectivity. Another possible use is listening to the foreign broadcast stations on 40 meters. And what about a Novice net where all the stations aren't on the same frequency? It's very convenient there, too.

This is just a minor modification, but it can take a deficiency of your HW-16 and change it into versatility, thereby making the rig easier and more enjoyable to own and operate.

My thanks go to Steve (WA2JZJ) for the excellent photographs. ...WN2REW

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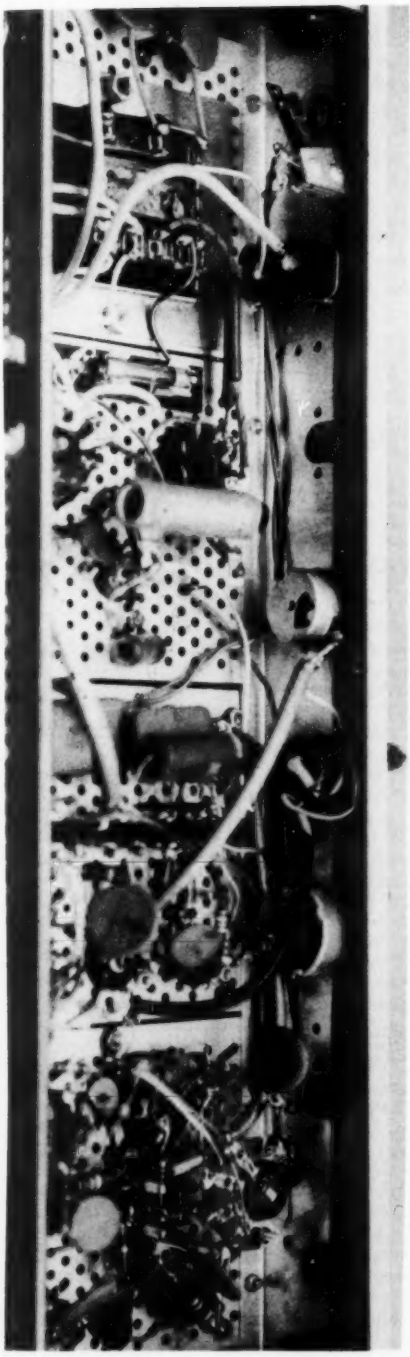
FM ADAPTER



requency modulation on the 2m band is increasing in popularity. One of the reasons is the availability of surplus FM equipment which can be converted to this use. However, the principal advantages of the FM mode are:

1. Improved signal-to-noise ratio.
2. Freedom from pulse-type interference.
3. Reduction in TVI.

A large percentage of the VHF receiver systems used by amateurs consist of crystal controlled converters ahead of a conventional hf receiver. It is possible to receive FM signals on such a system by detuning slightly so that the center frequency of the FM signal is at the steepest part of the i-f response curve. However, the noise and interference reduction advantages of FM cannot be realized under these conditions.

To realize the full merits of FM reception, an FM adapter can be used with a conventional hf receiver. The adapter to be described operates at an intermediate frequency of 455 kHz with a low impedance input. The latter permits use of coax cable connection to the hf receiver without disrupting the normal operation of the latter.

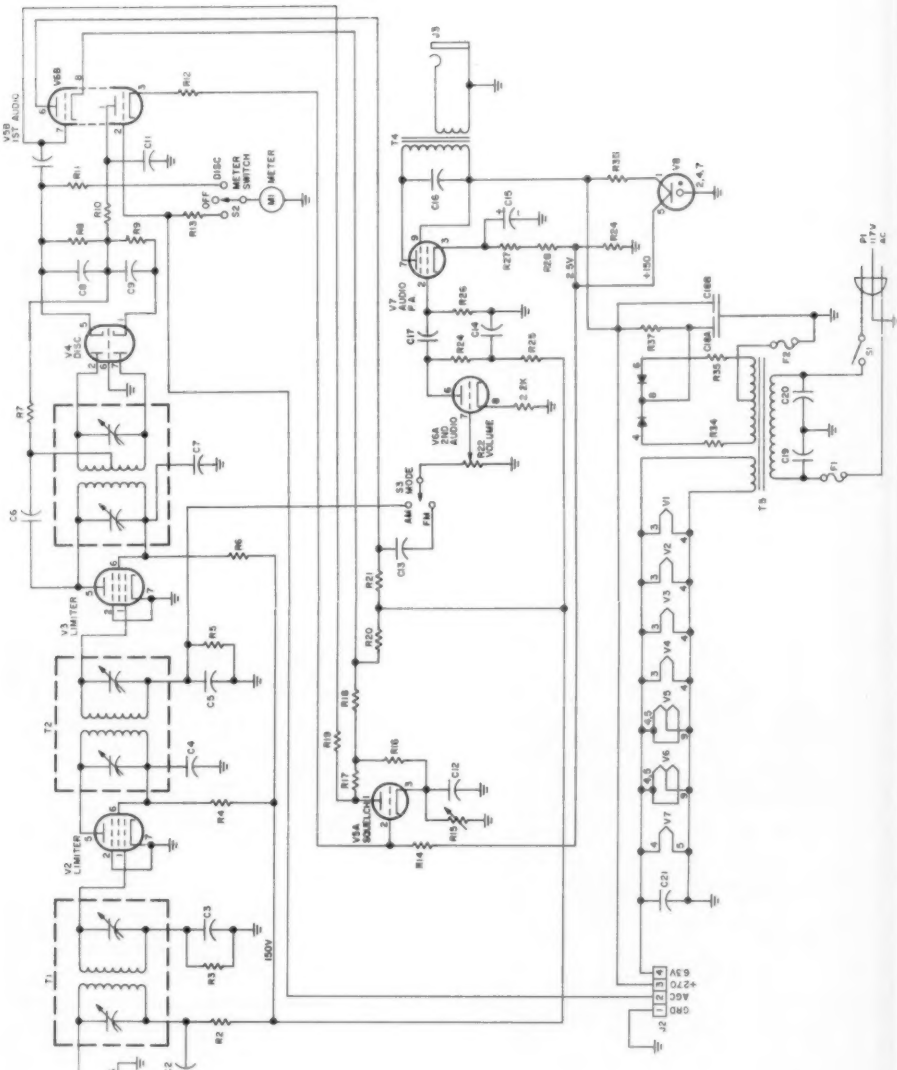

V5B 1ST AUDIO
V5A DISC
V4 LIMITER
V3 LIMITER
V2 LIMITER
V1 BUFFER
V6A SQUELCH
V6B 2ND AUDIO
V7 AUDIO
V8
T1
T2
T3
T4
J1 455 KHz INPUT
J2
J3
P1 117V AC
S1
S2 METER SWITCH
S3 MODE
M1 METER
DISC
OFF
AM
FM
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
R13
R14
R15
R16
R17
R18
R19
R20
R21
R22 VOLUME
R24
R25
R26
R27
R28
R31
R33
R34
R35
C1
C2
C3
C4
C5
C6
C7
C8
C9
C10
C11
C12
C13
C14
C15
C16
C17
C18
C19
C20
C21
F1
F2
150V
2.5V
4-150
2.2K
6.3V
+270
AGC
GRD

Figure 1 is a schematic diagram of the adapter. Metal work consists of components from the Lektrokit* chassis system. Four 4 x 4¾ in. chassis plates were used as follows:

Plate No. 1 carries the 6C4 buffer amplifier, first i-f transformer, 6AU6 first limiter, second i-f transformer, 6AU6 second limiter, discriminator transformer and 6AL5 discriminator.

Plate No. 2 carries two 5751 tubes, comprising the squelch and first audio section, the 6BQ5 audio power amplifier and the audio power output transformer.

Plate No. 3 holds a plug-in 20/20 μF 450V electrolytic capacitor, a plug-in rectifier assembly, 1N2389, and an OA2 regulator tube.

The fourth plate is taken up by the power transformer.

Fig. 1. Schematic. Parts List: R1, R25 – 1000Ω ½W resistor; R2, R16 – 1500Ω ½W resistor; R3, R14 – 470,000Ω ½W resistor; R4, R23, R32 – 2200Ω ½W resistor; R5, R8, R9, R10, R11, R12, R19, R21, R24 – 1000,000Ω ½W resistor; R6 – 21,000Ω ½W resistor; R7 – 68,000Ω ½W resistor; R13 – 1 MΩ ½W resistor; R15 – 1000Ω 4W variable resistor; R17 – 330,000Ω ½W resistor; R18 – 100Ω ½W resistor; R20 – 15,000Ω ½W resistor; R22 – 500,000Ω potentiometer; R26 – 390,000Ω ½W resistor; R27 – 100Ω 1W resistor; R28, R29, R34, R35 – 51Ω 1W resistor; R30 – 5000Ω 10W resistor; R31 – 1000Ω 10W resistor; R33 – 470,000Ω ½W resistor; C1, C2, C3, C4, C7, C10, C13, C17, C19, C20, C21 – ..01 μF disc ceramic 500V capacitor; C5, C6 – pF mica capacitor; C8, C9 – 200 pF mica capacitor; C11 – .15 μF paper capacitor; C12, C14 – .05 ceramic capacitor 300V; C15 – 25 μF, 25V, electrolytic capacitor; C16 – .003 μF mica capacitor 600V; C18A, C18B – 20 μF, 450V electrolytic capacitor; T1, T2 – 455 kHz interstage transformer. MILLER No. 512C2 or equivalent; T3 – 455 kHz output transformer. MILLER No. 512C3 or equivalent; T4 – 5000Ω primary, 500Ω secondary, audio transformer. STANCOR A3841 or equivalent; T5 – Power transformer. Primary 117V 60 cycle. Secondary #1 520V C.T., Secondary #2 6.3V, 4A. THORDARSON 26R31U or equivalent; S1 – Single pole, single throw toggle switch; S2 – Single pole, 3 position, lever switch; S3 – Single pole, 2 position, rotary switch; CR1 – Plugin, octal base, rectifier tube sutstitute 1N2389 or equivalent; F1 – Fuse, 3A, slo-blo; F2 – Fuse, 1/8A, slo-blo; M1 – Microammeter, zero center, 25-0-25; P1 – Power plug, Grounding type; J1 – BNC RF Receptacle, UG-625/U; J2 – 4-yin socket, Jones S-304-AB or equivalent; J3 – Phone jack.

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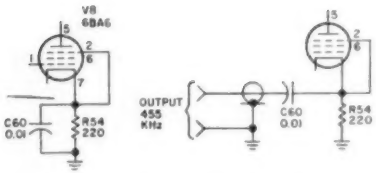

Fig. 2a. Original schematic GPR-90
b. Modified schematic, GPR-90.

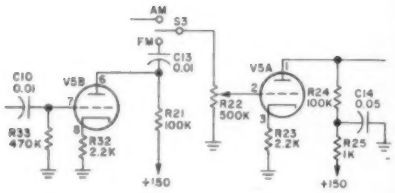

Fig. 3. Audio circuit without squelch.

The i-f input receptacle, J1 the accessory output receptacle, J2, and fuse, F1, are mounted on the rear panel of the chassis assembly. The front panel carries the audio output jack, J3, the power switch, S1, volume control, R22, AM-FM switch, S3, squelch adjust, R15, meter switch, S2, and the tuning meter, M1.

Buffer stage, V1, provides a low impedance input and isolates the first i-f transformer from the influence of external connections. If the hf receiver does not have a low impedance output, one can be provided fairly simply. Figure 2 shows how this was done for a GPR-90 receiver. Figure 2a is a partial schematic of the third i-f stage. Figure 2b shows the change to give a low impedance output; the bypass capacitor for the cathode resistor of the third i-f tube was lifted off ground and taken to an output jack. A shorting plug can be applied to the output jack when the FM adapter is not in use. It should be noted that the bandwidth at the receiver output jack is governed by shorting plug can be applied to the output jack when the FM adapter is not in use. It should be noted that the bandwidth at the receiver output jack is governed by the preceding stages. If wideband response is required, the takeoff should be at an earlier i-f stage (with subsequent loss in gain).

V2 functions as a conventional amplifier-limiter. Its input and output uses conventional 455 kHz i-f transformers. V3 acts as a limiter for FM reception, but is a detector for AM reception. In the latter case, the AM envelope is taken off the grid resistor, R5, for V3.

*A.P.T. Electronics Industries, Ltd., Chersy Road Byfleet, Surrey, England.

A discriminator transformer, T3, was produced by adding the phasing network C6, R7, to a standard full-wave detector transformer. V4 is a Foster-Seely discriminator. It provides the following outputs:

1. Audio signal through coupling capacitor C10.

2. AGC voltage through R10 and J2 to the hf receiver.

3. Squelch voltage through R10, V6B and R12 to the squelch tube, V5A.

4. Tuning indicator voltage through R10 and R13 to the tuning meter, M1.

5. Discriminator voltage through R11 to the tuning meter for tuning or adjustment of T3.

V5B is a squelch-controlled audio amplifier which is used only for FM reception. V6A and V7 form the remainder of the audio system. The cathode resistors for V7, R27, R28 and R29, form a voltage divider to obtain approximately +2.5V delay voltage for the squelch tube, V5A. V6B is used as a diode to isolate this positive voltage.

With no input signal to the adapter, the positive delay voltage appears at the grid of the squelch tube, V5A, causing the tube to draw maximum current. The current flowing through its plate resistor, R17, produces a voltage drop at the grid of the first audio tube, V5B, thus cutting off operation of this tube. For signal conditions, the negative squelch voltage, applied through the diode, V6B, overcomes the positive delay voltage. This cuts off squelch tube, V5A, and the first audio amplifier stage operates at normal gain. The sensitivity of control for V5A is adjusted by R15.

In case it is not desired to incorporate the squelch circuitry, one 5751 tube can be eliminated. The audio schematic would then be as indicated in Fig. 3.

It should be noted that all stages, except the audio power amplifier, operate from a regulated plate voltage of 150. The PA stage has a 500Ω output. A 5000Ω to Voice Coil transformer may be substituted for T3 if desired.

In order to insure compatibility with the hf receiver with which this FM adapter is to be used, it is desirable to use all the receiver during the alignment process.

Set the signal generator for any convenient frequency within the range of the hf receiver and turn on the tone modulation. Tune the receiver for maximum response as indicated on the receiver's S-meter. Set adapter mode switch to FM and the meter switch on TUNE. Adjust T1, T2, and T3 for maximum response on the meter. Throw meter switch to DISC. and adjust the secondary of T3 so that the meter reads zero center. At the same time, monitor the audio output which should decrease in level as the meter needle is centered. Turn off the signal generator and adjust the squelch control, R15, so that the background noise in the output of the FM adapter just fades out. This completes the alignment.

In operation, the meter switch is normally left on TUNE. However, the discriminator adjustment should be checked occasionally by switching the meter to DISC.

This unit should provide quiet, effective reception of FM signals. All parts are readily available and the chassis system makes construction simple.

. . .W1LE

References:

1. Reception of F.M. and P.M. Signals. The Radio Amateur's Handbook, ARRL, Forty-sixth Edition. Pages 128–129.
2. Reception of FM Signals. The Radio Handbook. Editors and Engineers, Ltd. Seventeenth Edition. Pages 319–324.
3. F.M. Reception. R.S.G.B. Amateur Radio Handbook, Third Edition. Pages 338–341.
4. Frequency Modulation. John F. Rider Publisher, Inc.
5. Frequency Modulation. August Hund. McGraw–Hill Book Co., Inc. First Edition. Chapter IV.
6. Radiotron Designers Handbook. F. Langford-Smith. Fourth Edition. Pages 1088–1105, 1149–1150.
7. Handbook Preferred Circuits, NAVWEPS 16-1-519, National Bureau of Standards. Pages 60–2, 60–3, 64–2, 64–3.

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This book is largely a collection from FM Bulletin, edited by K6MVH and WA8UTB. The material is taken from the editions of February 1967 through February 1968.

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Repeater Bulletin $2.00 yr
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The Bulletin is the place where the mass of FM information is published that doesn't make it into 73 because there just isn't enough room. It runs about 24 pages per month (8½ x 11).

If you are interested in a subscription, send your name, call, address, including zip, a list of the FM equipment you are using, the repeaters you use, and any repeater clubs or other amateur radio clubs that you are a member of.

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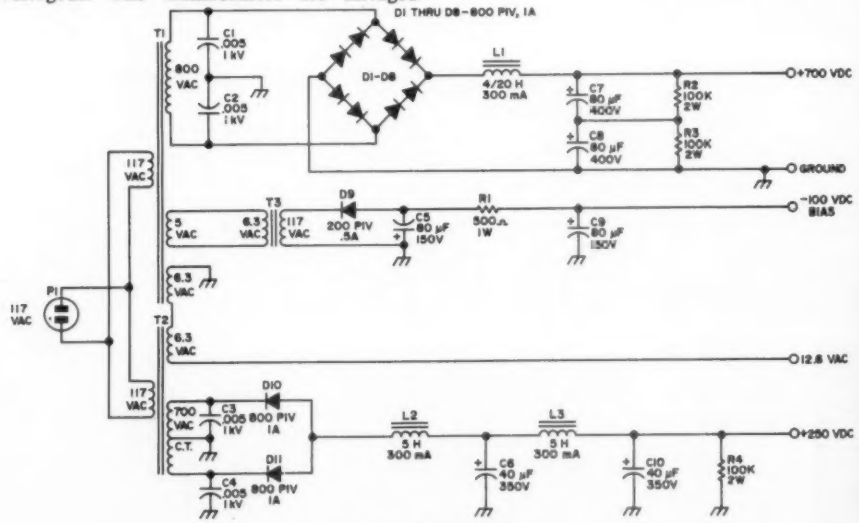

Fig. 1. Power supply.

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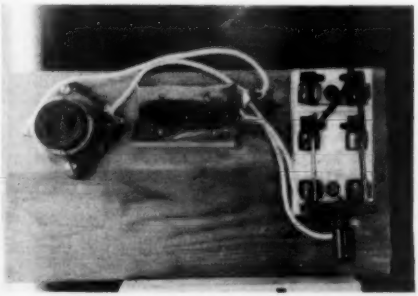
Here is a practical, useful little gadget that is easily constructed, and is so simple, it is ideal for a first construction project for a Novice. Just a simple timer that will turn a rig on automatically so when your sked time arrives, the rig will be all warmed up and help avoid undesirable frequency drift.

The heart of this timer is a cheap alarm clock. One that, when the alarm goes off, a key on the back of the clock turns or unwinds. My clock cost $1.98 and has worked perfectly now for four years. When the key turns, it drops off a shorting piece of metal, closing the ac circuit, as explained below.

The base board may be of any material. Mine is just a small board, 5 x 7 in. Its size, and the arrangement of parts, is not critical. If you wish you may rig a dust-cover, using a cardboard box painted with black paint.

You will need these parts: clock, ac plug and cord to reach from timer to electric outlet supplying current to your rig, DPST switch to open the ac line, socket to plug your rig into and a fuse holder and fuse, if you wish one. The switch that does the turn-on job is made from 2 lengths of ¾ round wood, about 3 in. or so long. You will need a few square inches of copper foil to cover the ¾ round wood pieces.

Glue a brad about 3/8 in. or so long onto the key on the back of your clock. Use



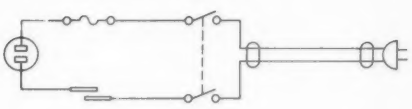


Fig. 1. Timer. Parts: 1. Socket to plug transmitter into. 2. Fuse – any kind is OK. 3. Switch – 2 pieces of ¼ round, copper covered. 4. DPST switch. 5. Cord long enough to plug into electrical outlet. 6. Plug.

epoxy glue, and it will hold for years. Cut a brass or copper disc or square piece of stock about 5/8 in. or so, round or square, and drill a small hole in it toward one side, to fit easily over the brad on the clock key.

Cover the two pieces of ¼ round with copper foil and connect a wire to each and fasten the ¼ rounds to the base, very close together. The distance apart is such that when the metal piece drops on the two ¼ round pieces, it closes the circuit across the two pieces. Leave room for your clock to sit on the base, directly in front of the ¼ round "switch."

Set the alarm on the clock for the desired turn-on time; put the piece of metal on the brad on the clock key, and set the clock on the base so that the brad is up above the ¼ round "switch." When the alarm sounds, the key will turn, dropping the metal piece off the brad and letting it fall onto the "switch," closing the circuit. That's it!

I leave the rig switch on, and turn the rig off by opening the DPST switch, which takes all current off everything so you can pick up the metal piece and have it ready for the next time. Be sure to use a double pole switch so that both sides of the ac line are entirely cut off. If your junkbox won't provide a DPST switch, you can buy one at a very low price.

My timer uses a DPDT switch with one pair of contacts not used – just because I had this switch in the junkbox.

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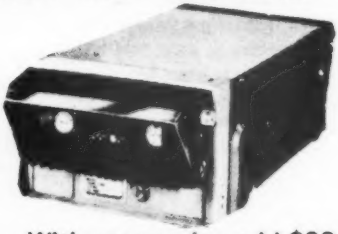
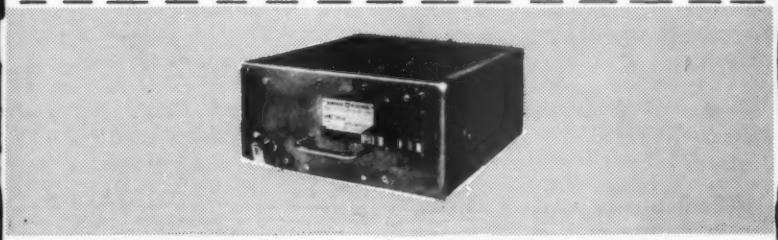


With accessories, add $30.



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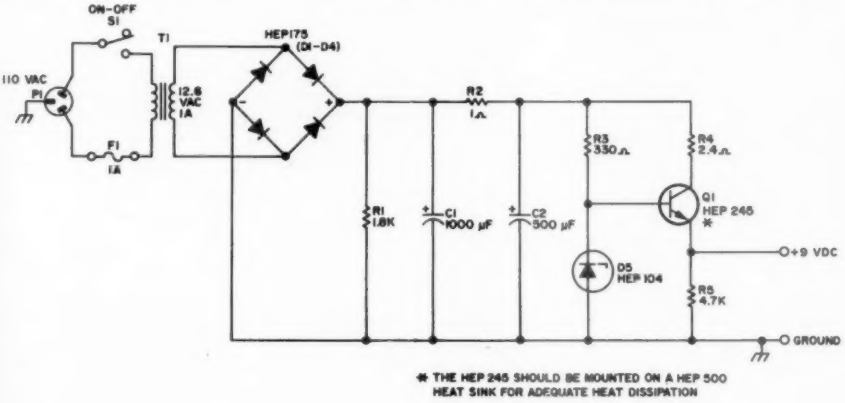
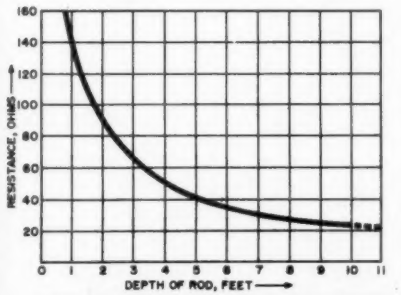
CIRCUITS, CIRCUITS, CIRCUITS...

The following circuits have appeared in the referenced books, magazines, application notes, etc. While we try to reproduce all of the information that should be needed by an experienced constructor, readers may want to avail themselves of the original sources for peace of mind.

Readers are requested to pass along any interesting circuits that they discover in sources other than U.S. ham magazines. Circuits should be oriented toward amateur radio and experimentation rather than industrial or computer technology. Submit circuit with all parts values on it, a very brief explanation of the circuit and any additional parts information required, give the source and a note of permission to reprint from the copyright holder, if any, and the reward for a published circuit will be a choice of a 73 book. Send your circuits to 73 Circuits Page, 73 Magazine, Peterborough NH 03458.

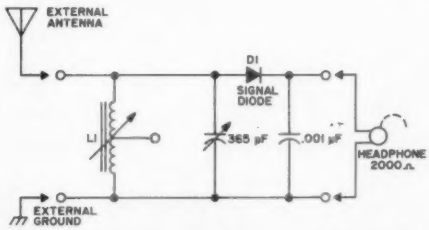


Simple power supply. Circuit courtesy of Motorola Construction Projects.

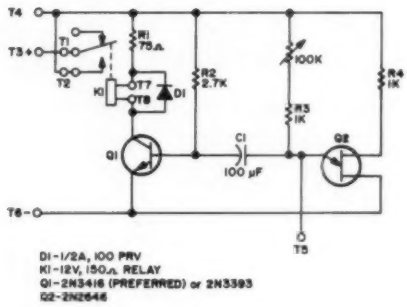


EARTH RESISTANCE DECREASES WITH DEPTH OF ELECTRODE IN EARTH.

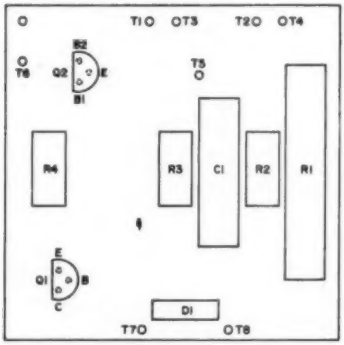
When you find that your earth-electrode resistance is not low enough, there are several ways you can improve it: 1) Lengthen the earth electrode in the earth; 2) Use multiple rods; 3) Treat the soil. As you might suspect, driving a longer rod deeper into the earth, materially decreases its resistance. In general, doubling the rod length reduces resistance by about 40%. *The curve at left shows this effect. For example, note that a rod driven two feet down has a resistance of 88Ω; the same rod driven 4 feet down has a resistance of about 50Ω. Using the 40% reduction rule, 88 X 0.4 = 35Ω reduction. A 4-foot deep rod, by this calculation would have a resistance of 88–35 or 53Ω – comparing closely with the curve values.*



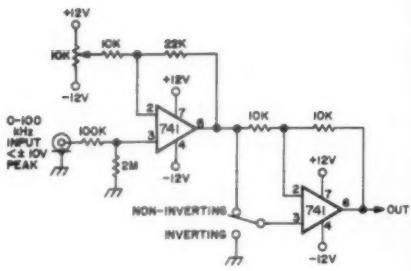
Crystal diode receiver, the simplest radio possible, runs forever without batteries. Signal diode is Calectro K4-550. Circuit courtesy of GC's Calectro Handbook.



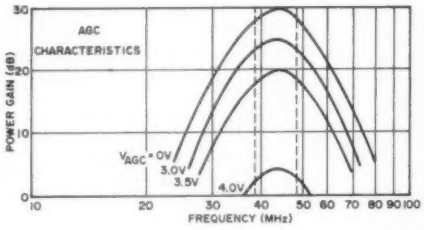
D1-1/2A, 100 PRV
K1-12V, 150Ω RELAY
Q1-2N3416 (PREFERRED) or 2N3393
Q2-2N2646

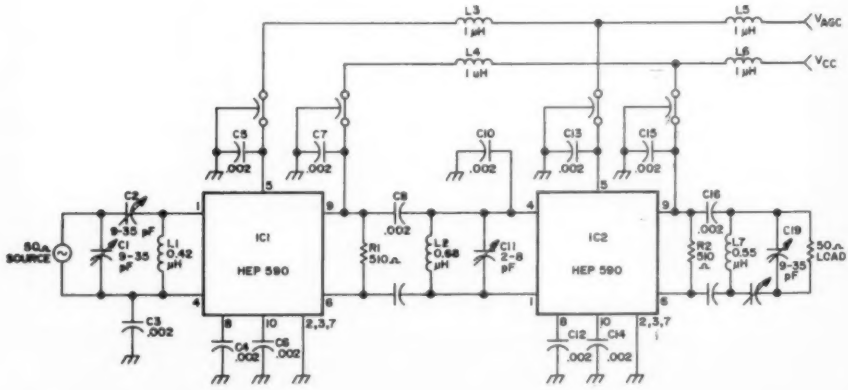


Timer board, adjustable 0 ~ 20 seconds. R1 – 12V, 150Ω relay; D1 – ½ amp, 100V; Q1 – 2N3416 (preferred) or 2N3393; Q2 – 2N2646 (K6AEH).

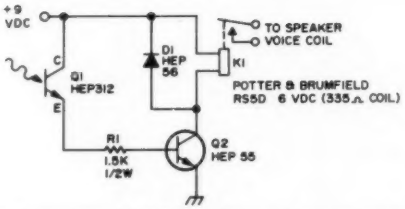


Low speed counter, scope or audio dc input level and polarity switcher. This circuit will change the level of the input signal by means of the pot. The polarity (rise and fall) may be inverted by means of the switch. (Thanks to WØLMD)

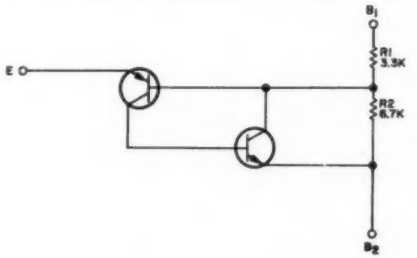




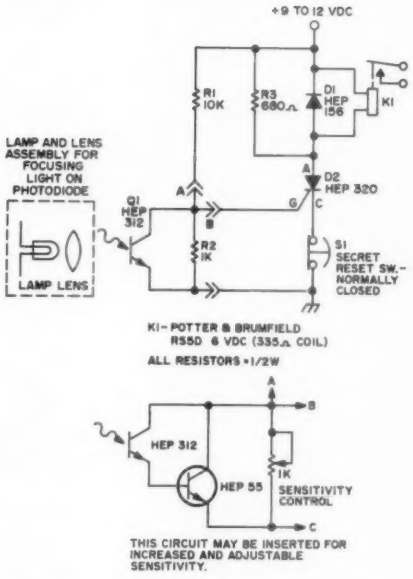
Wide band 45 MHz amplifier, with chart showing AGC characteristics. Circuit courtesy of Motorola.



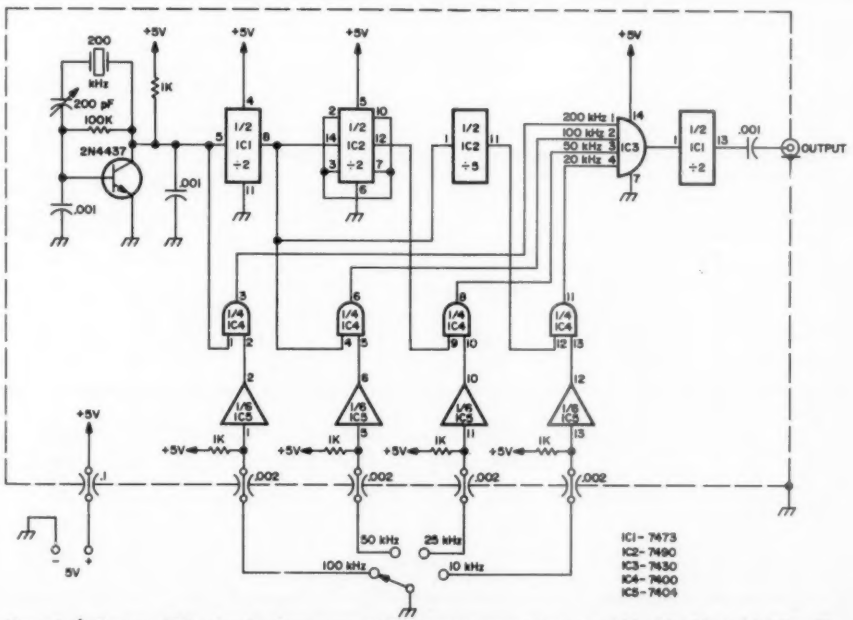
T.V. commercial killer, with no interconnecting wires. Use a flashlight to key relay. Circuit features low battery drain, auto reset. Courtesy Motorola construction projects.



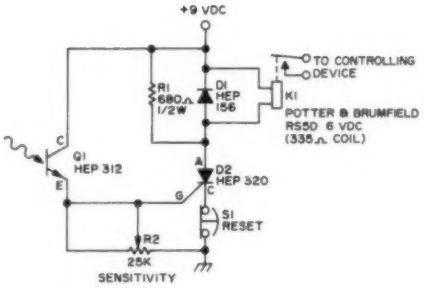
2 transistor – 2 resistor equivalent of a programmable unijunction transistor (credit WB2VKU).



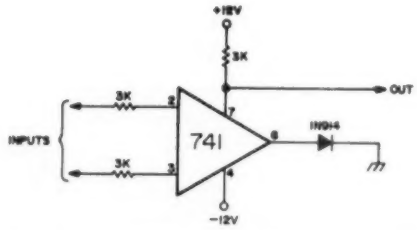
Burglar alarm (photoelectric) will actuate alarm when light beam is broken. Courtesy Motorola construction projects.



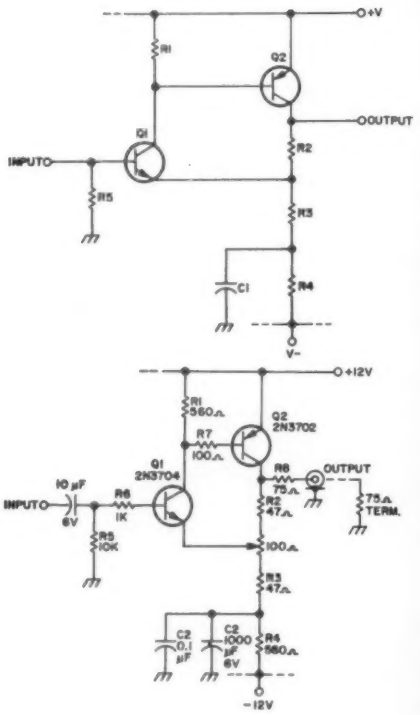
Crystal calibrator. This circuit gives symmetrical square waves out on 100, 50, 25 & 10 kHz. The frequency switch may be any distance from the totally shielded calibrator, as the lines have only dc levels. (Thanks to WØLMD)



Headlight operated garage door or light switch. Relay contact will close when light hits photodiode. Sensitivity adjustment is provided to prevent false triggering. Circuit courtesy of Motorola construction projects.



741 used as a high speed comparator. The output of this circuit varies from +12 to +2 volts and back with extremely fast rise and fall times. (Thanks to W0LMD)

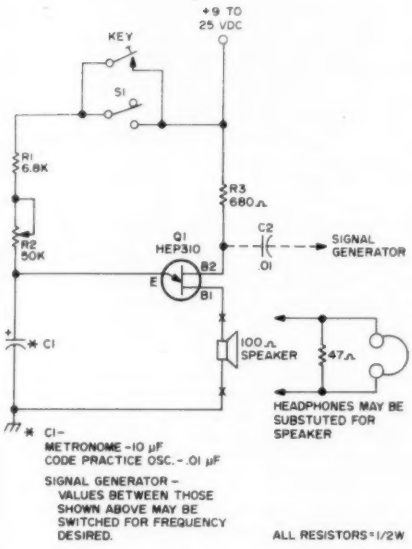


Two transistor video amplifier, medium input impedance (5K) and low output impedance. Almost any small signal HF transistors will work in the circuit but ideally they should have a high cut-off frequency, reasonably high current gain and low output capacitance. In deciding on circuit values, the value of R3 should lie between about 22Ω and 100Ω and the value of R2 chosen to suit the gain required. Courtesy, Journal of BATC.

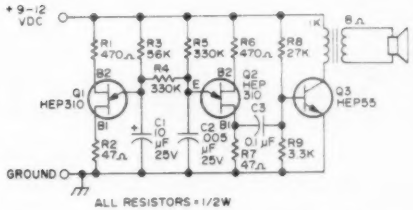
Power Watts	1.6–3.5 MHz	28–29.7 MHz	35–36 42–44 50–54 MHz	144 – 148 150.8 – 161.6 MHz	450–460 MHz
10	40	100	40	15	10
50	90	220	90	35	20
100	125	360	130	50	30
180	–	–	–	65	40
250	200	490	205	75	45
500	–	–	290	–	–
600	300	760	315	115	70
1,000	400	980	410	150	90
10,000	1,250	–	1,300	–	–

Recommended safe distances, in feet, from blasting sites for mobile transmitters.

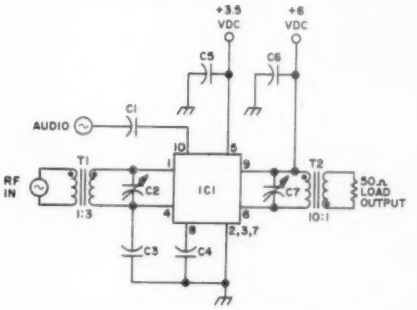
Reprinted from the British Columbia FM Comm. Assn.



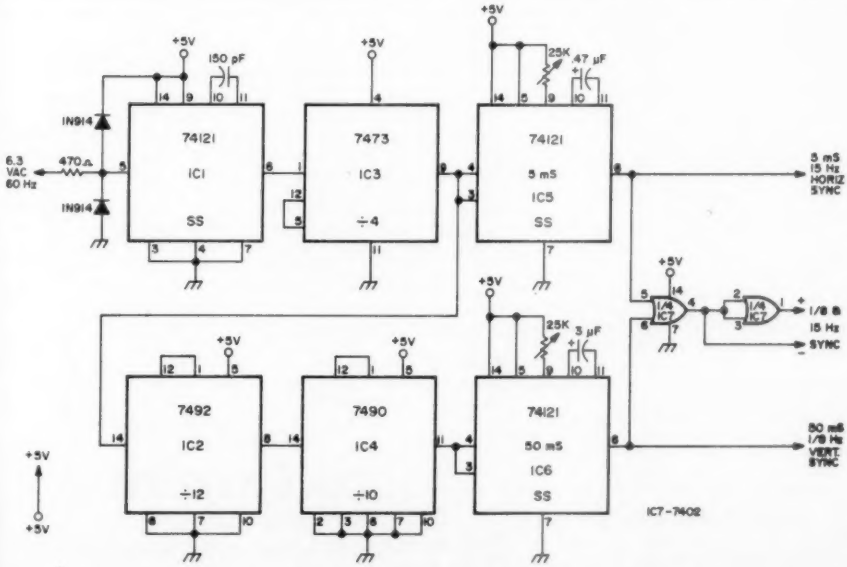
Metronome or code practice oscillator and audio generator.



Siren oscillator with an attention getting rising and wailing output. Use with burglar alarm, for instance.



6 meter AM modulator using a Motorola HEP590.



SSTV frequency standard. This simple circuit provides the needed pulses for slow scan TV cameras, flying spot scanners, and pattern generators (thanks to W0LMD).

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MFE3007	Dual-gate	$1.98
40673	Dual-gate	$1.75
3N140	Dual-gate	$1.95
3N141	Dual-gate	$1.85

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Sponsored by the Champaign–Logan County Amateur Radio Club. Will be issued for contacts made during field day and one of the VHF contests with the club station W8EBG; operating at Ohio's highest point located in Bellefontaine, Ohio. Only contacts made after June 1, 1972 will count. Send $1.00 or seven IRCs to cover cost of handling and mailing to: John L. Wentz, Box 102, West Liberty, Ohio 43357.

RADIO CLUB OF TACOMA HAM-FAIR will be August 19th and 20th at the Sportsmen's Chateau, 164th and Canyon Road, south of Tacoma. Activities will include contests, transmitter hunts, technical talks and displays, manufacturer's displays, auction, country store, beauty contest, and door prizes. Grand prize will be a solid-state 2 meter transceiver. Talk-in frequencies – 146.76 and 3965. Camping–$1.50 per night with electrical hookup. Advance registration will cost $5.00 and includes Saturday evening dinner, or $3.00 without dinner. Contact Emil Koth, K7GPK, 13616 10th Ave. East, Tacoma, Washington 98445, for registration forms or motel information.

ROCKFORD AMATEUR RADIO ASS'N The Bel-Rock Hamfest will be held August 20 at the Boone County Fairgrounds just north of Belvidere, Illinois on highway 76. Free coffee and donuts from 9:30 to 10:00 AM. There is no set-up fee and plenty of free parking is available. Talk-in on 146.94 MHz. Advance tickets are $1.00, $1.50 at the gate. For further information, contact: Lee Gehlausen, WA9WVY, 4610 Cayuga, Rockford, IL 61107.

SWAPFEST & PICNIC Sunday August 13, at the City Park in Levelland, Texas. Sponsored by the Northwest Texas Emergency Net and the Hockley County Amateur Radio Club. This event is for the entire family. Bring your own picnic basket. Free registration begins at 0900. Lunch at 1300. Swapping all day. Mobile talk-in frequency is the Net Frequency of 3950 kHz & 146.28–88, the Levelland Repeater (WB5EMR) or 146.34–94, through the Lubbock repeater.

7TH. ANNUAL MELBOURNE HAMFEST sponsored by the Platinum Coast A.R.S., will be held September 16th and 17th at the Melbourne Florida Civic Auditorium. Hours: 9 AM – 4 PM. Bring your gear to sell or trade. Plenty of paved parking. Registration $1.50 for each adult. Children free. For more information write Donald E. Sanders W4BWS, 1422 Virginia Drive, Melbourne, Florida 32935.

The annual Iowa 75 meter phone net will be held on the third Sunday in August, August 20, 1972, at Riverview Park in Marshalltown, Iowa. All amateurs and their families are cordially invited, or anyone interested in amateur radio. Each should bring a covered dish and his own service. Festivities will begin around noon. Prizes will be offered and a swap table will be available.

PRAIRIE DOG AMATEUR RADIO CLUB of South Dakota will hold its Summer 1972 picnic August 19th and 20th at the Isaac Walton League Club House on Lewis & Clark Lake west of Yankton, South Dakota. The festivities will begin at 1:00 PM Saturday with a talk-in on 3955 KHz and 146.94 MHz. There will be swap tables and a social get-together, transmitter hunt, films, tours of Electronics manufacturing plants and the Gavins Point Dam. Special interest sessions, programs for the ladies, bingo, and nearby swimming facilities promise to make this the event of the year. To pre-register, send $4.00 to P.D.A.R.C., PO Box 321, Yankton, South Dakota 57078.

The Shenandoah Valley Amateur Radio Club will hold their annual Hamfest in Winchester, Va. the weekend of August 5th and 6th.

A kick off Dinner will be held Saturday night, tickets $5.00 each. The Hamfest will begin Sunday at 10:00 AM at the Winchester National Guard Armory admission free. Registration for door prizes $1.00 each (no limit). For further information write for flier.

Shenandoah Valley Amateur Radio Club Inc. PO Box 139, Winchester, VA 22601.

The fourth annual Danville Hamfest will be held September 3 at Douglas Park. 146.94 will be monitored along with the Danville 22/82 and the Champaign–Danville 34/76 machines for talk-in traffic. $1 advance registration and $1.50 at the gate. For further information write Alan Woodrum WA9IAC, 1615 N. Bowman, Danville IL 61832.

The Zero-Beaters Annual Hamfest will be held Sunday, August 6, 1972 in the City Park at Washington Mo. Door prizes, free ham gear auction, free bingo for the ladies. Cake walk, free candy scramble for the kids.

The HAMFESTERS 38th Hamfest and Picnic will be held on Sunday, August 13, at the Santa Fe Park, Willow Springs, IL, southwest of Chicago. Exhibits for OM's and XYL's, famous swappers row. For information and tickets write to Joseph W. Poradyla, WA9IWU, 5701 S. California Ave. Chicago, IL 60629.

The Texas VHF-FM Society will hold its annual summer convention August 11, 12, and 13 at the Villa Capri Motor Hotel in Austin, Texas. Technical sessions, manufacturers' displays, door prizes, ladies activities. Call-In will be through the Austin 34-94 repeater. For more information write Gene Chapline, K5YFL, 2206 La Casa, Austin, TX 78704 or Larry Higgins, W5QMU, 2522 Old Hickory Trail, San Antonio, TX 78230.

The Burlington Amateur Radio Club, Inc, Burlington, Vermont, will sponsor the *1972 INTERNATIONAL FIELD DAY* at the Old Lantern, Charlotte, Vermont, on Sunday August 13, 1972.

Outstanding features include the Flea Market, Contests, Demonstrations, special events for the Ladies and the Rock Crowd. Refreshments available all day, excellent camping facilities on grounds, Saturday Nite Happy Hour from 6 to 12 PM. Come a few days early – talk in on 34-94, 22-82, 16-76, 28-88, all mountain-top machines (natch).

Registration $3.50 at the gate, $3.00 early bird. Write to: Al Snow, K1SLU, 12 Duchess Ave. S. Burlington, Vermont 05401. For more information contact IFD chairman Bob Hall, W1DQO, General Green Rd Shelburne, Vermont 05482. Phone (802) 985 – 2235.

On the 23rd and 24th of September, 1972, the North West Amateur Radio Conference is being held at the University of Lancaster, and they would like to extend a warm welcome to any American amateurs who will be in Britain at that time to attend the conference. Any interested amateur may write to Mr. Philip Jones, Department of Environmental Sciences, The University, Bailrigg, Lancaster, England.

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W2NSD *(continued from page 70)*

tution and by-laws finally were mailed to the repeater groups. There is no hint yet as to how many groups will join the Association. The by-laws leave out more than they include, so some groups feel that in joining they are signing a blank check. No proposal has been made of expenses or goals for the NRA. When questioned about what the NRA could do for the repeater groups, the answer from Bob Waters was, "Don't ask what the Association can do for your group, just what your group can do for the Association." Some groups may want more than mere slogans to justify sending hard earned cash to Waters and Pugh in exchange for unstated goals and benefits.

The sudden resignation of Gary Hendrickson W3DTN, a highly respected Philadelphia FMer, as Secretary of the NRA immediately after the April meeting has not increased overall confidence in the Association.

. . .Wayne

W7DXX *(continued from page 160)*

all the reps of the manufacturers for a very good "Kass-vention." We'll see you there next year.

With both the Editor and Managing Editor of 73 avid DXers we decided to update the 73 hamshack. So, we replaced the Galaxy V, which has given years of faithful service, with the Kenwood Twins from Henry Radio. The trusty 3 element 20 meter beam, the one with the driven element 40 degrees off horizontal since the last snow storm, is being replaced by a 7 element 20 meter beam from Wilson Electronics. We have two other stations under construction. One is a Signal One CX7-A transceiver and the Alpha 70 amplifier. The other is our VHF station for 6 meters through 450. We will be using the Kenwood Twins for SSB and SSTV while the Signal One pair will be used for serious DXing both on SSB and CW. Other antennas include 7 elements on 15, 6 elements on 10, and a 4 element quad up 100 feet. The only problem we are going to have is putting out the magazine with all that new equipment to use.

I want to remind you again about the 73 DXpedition to Bajo Nuevo in November. We need a few more operators. If you can dig the idea of a DXpedition to a remote island, give me a call now. The cost will be around $500 per person. Also, the idea of DX is catching on. So, if your group has not written and called for information, do so now.

. . .W7DXX/1

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	T5IGGV;	60 watts out, 6/12 vibrator power supply	75.00
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RCA	CMC20;	20 watts out, 6/12 volt vibrator power supply	45.00
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MOTOROLA	U43GGT;	30 watts out, transistor power supply, with accessories	110.00
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William P. Turner WAØABI
5 Chestnut Court
Saint Peters MO 63376

GDO COIL EXTENSION

A grid dipper is a great piece of test equipment and belongs wherever rf equipment is to be designed, constructed, or serviced. All writings on the subject seem to be prefaced with this comment, and I hesitate to break tradition. Now that the formalities are over, we will proceed with the subject matter.

Probably the one most inconvenient feature of all grid dip meters is the physical size of the instrument. This holds true for the two unit commercial models as well as the more common self-contained types. It is not so much that they are large but rather that the head will not always fit into the nooks and crannies which seem to be designed into most equipment. This situation will more than likely become more severe as integrated circuits come into more general use. At lower frequencies the coil assembly is usually long enough to reach to within shouting distance of the desired circuit, but as the frequency is increased the dipper coil shrinks to perhaps an inch protruding from the case. Try getting this even near a circuit buried 2 or 3 in. deep in a chassis and you will fully appreciate the magnitude of the problem.

There is a way of relieving the difficulty which requires neither a great deal of time nor expense. It is only necessary to put to use some basic theory which each of us was required to know in order to get a ham license. Required are perhaps a 3 ft length of small coax (RG 174/U), 6 in. of hookup wire and a ballpoint pen casing. The innards of the pen are removed, and the business end reamed slightly to accept the ends of a ½ in. diameter one turn link formed of hookup wire. Inside the barrel of the pen the ends are soldered to the coax, insulated, and cemented in place. The remaining wire is formed into a 2 turn link which fits snugly on the coil form of your grid dipper. This link is soldered to the opposite end of the coax and secured. Shrinkable tubing is perfect to cover the joint.

The next time you face this perplexing problem hold your head high and fear not. Merely slip the link over the coil form, place your probe so as to allow coupling into the desired circuit and proceed as usual. The only difference will be a more or less fixed load on the oscillator which doesn't affect its ability to indicate resonance. As always, best results are obtained with minimum coupling.

. . .WAØABI

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7403	.26	.25	.23	.22	.21	.20
7404	.28	.27	.25	.24	.22	.21
7405	.28	.27	.25	.24	.22	.21
7406	.52	.50	.47	.44	.42	.39
7407	.52	.50	.47	.44	.42	.39
7408	.32	.30	.29	.27	.26	.24
7409	.32	.30	.29	.27	.26	.24
7410	.26	.25	.23	.22	.21	.20
7411	.28	.27	.25	.24	.22	.21
7413	.58	.55	.52	.49	.46	.44
7416	.52	.50	.47	.44	.42	.39
7417	.52	.50	.47	.44	.42	.39
7420	.26	.25	.23	.22	.21	.20
7421	.26	.25	.23	.22	.21	.20
7423	.80	.76	.72	.68	.64	.60
7425	.50	.48	.45	.43	.40	.38
7426	.34	.32	.31	.29	.27	.26
7430	.26	.25	.23	.22	.21	.20
7437	.56	.53	.50	.48	.45	.42
7438	.56	.53	.50	.48	.45	.42
7440	.26	.25	.23	.22	.21	.20
7441	1.73	1.64	1.55	1.46	1.37	1.27
7442	1.27	1.21	1.14	1.07	1.01	.94
7443	1.27	1.21	1.14	1.07	1.01	.94
7444	1.27	1.21	1.14	1.07	1.01	.94
7445	1.71	1.62	1.53	1.44	1.35	1.26
7446	1.24	1.17	1.11	1.04	.98	.91
7447	1.16	1.10	1.04	.98	.92	.85
7448	1.44	1.37	1.29	1.22	1.14	1.06
7450	.26	.25	.23	.22	.21	.20
7451	.26	.25	.23	.22	.21	.20
7453	.26	.25	.23	.22	.21	.20
7454	.26	.25	.23	.22	.21	.20
7460	.26	.25	.23	.22	.21	.20
7470	.42	.40	.38	.36	.34	.32
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7475	.80	.76	.72	.68	.64	.60
7476	.56	.53	.50	.48	.45	.42
7480	.76	.72	.68	.65	.61	.57
7482	.99	.94	.88	.83	.78	.72
7483	1.63	1.55	1.46	1.38	1.29	1.20
7485	1.42	1.35	1.27	1.20	1.12	1.05
7486	.58	.55	.52	.49	.46	.44
7490	.80	.76	.72	.68	.64	.60
7491	1.43	1.35	1.28	1.20	1.13	1.05
7492	.80	.76	.72	.68	.64	.60
7493	.80	.76	.72	.68	.64	.60
7494	1.18	1.12	1.05	.99	.93	.87
7495	1.18	1.12	1.05	.99	.93	.87
7496	1.18	1.12	1.05	.99	.93	.87
74100	1.52	1.44	1.36	1.28	1.20	1.12
74107	.52	.49	.47	.44	.42	.39
74121	.56	.53	.50	.48	.45	.42
74122	.70	.67	.63	.60	.56	.53
74123	1.21	1.06	1.00	.94	.89	.83
74141	1.63	1.55	1.46	1.38	1.29	1.20
74145	1.41	1.33	1.26	1.18	1.11	1.04
74150	1.63	1.55	1.46	1.38	1.29	1.20
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74156	1.46	1.39	1.31	1.23	1.16	1.08
74157	1.56	1.48	1.39	1.31	1.23	1.15
74158	1.56	1.48	1.39	1.31	1.23	1.15
74161	1.89	1.79	1.68	1.58	1.47	1.37
74164	1.89	1.79	1.68	1.58	1.47	1.37
74166	1.93	1.87	1.76	1.65	1.54	1.43
74180	1.20	1.13	1.07	1.01	.95	.88
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74193	1.93	1.87	1.76	1.65	1.54	1.43
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1N914	.10	.09	.08	.07	.06	.05	1N4154	.15	.14	.13	.12	.11	.10
1N4001	.10	.09	.08	.07	.06	.05	2N3860	.25	.23	.21	.19	.17	.15
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50 MEGAHERTZ DX

Paul Schuett WA6CPP
14472 Davis Road
Lodi CA 95240

After I worked some fine DX on six this summer, I have come up with some conclusions to pass along to other VHF devotees:

It would appear that the band is open more than most of us suspect. The problem is that there is nobody around working the openings. Of course, there are lots of people *listening* – it's just that they are all sitting in the shack minding their own business without even knowing about the opening. Since most openings come to light when you hear some exotic contact making some noise, take advantage of the situation and make some noise yourself – so the other fellow can hear you.

The easiest way is to engage in a local QSO, but orient your antennas in various directions. Now and then I'll talk with a fellow eight miles away. Aligning the antenna on a precise aximuth for such a distance is not necessary (the signals are so good that they come in on the noise blanker), so one of us aligns the antenna northeast; the other southeast. We cashed in on this with a breaker from Albuquerque.

There is no need to run out of things to talk about, unless you are particularly boring yourself. Talk about anything – the weather (yesterday, today, tomorrow); articles in the current issue of *73* (if he doesn't have it, you can read the article to him); discuss paragraphs from the FCC Manual (it is surprising the number of people who have forgotten some of the rules, or at least don't use them consistently); practice code, or anything else. We had a 3-way round table that had a break-in from Colorado in this manner. When the other guy hears you, he will come in.

It's a good idea to use your VOX instead of PTT, since you can hear the breaker and not ramble on for another five minutes or so and miss the DX because of changing conditions.

Nobody to talk to? Then make a lot of noise every ten minutes or so. A CQ only takes one line in the log, and you might turn up something fascinating. A fellow from Texas heard my CQ one morning – neither of us had any idea the band was open.

The call CQ DX is silly. If any DX stations hear, you can be sure they will answer; they are as anxious to work double-hop as you are. Most of these calls end up with a local contact anyway, so we are back making noise, which will be picked up on an opening.

Be a gentleman when the band is open. It is amazing how many nice guys turn into fiends with sharpened teeth when the band opens.

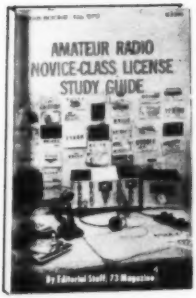
1. Don't tune your transmitter on the working frequency. Move up a way; things won't change that much, and the rest of us won't have to work through the carrier.
2. Don't send on top of someone except to give your call. One fellow was calling CQ in CW on top of a DX QSO, making it impossible to hear the stations' IDs.
3. Wait your turn in a pileup. If someone else is transmitting, bite your fingernails until he's through.
4. Don't ragchew in a pileup. Others are waiting. Remember the Golden Rule. Ragchew when it is apparent everybody around has checked in and you have a roundtable going.

My first Ohio contact was marred by somebody hollering *INTERFERENCE INTERFERENCE INTERFERENCE . . .* " all the way through the 4-minute QSO. If this guy has a gripe, let him get on the air and tell me – I'll apologize. Meanwhile, like the rest of us, such a person should simply wait his turn, then give the desired station a call.

These suggestions have been successful in detecting elusive 6-meter openings. Let's not sit around listening – let's make some noise to let the DX know we're around.

. . . WA6CPP

Free Free Free Free Fr



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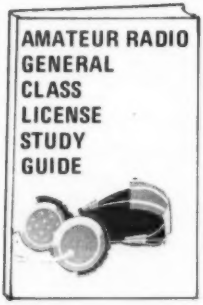

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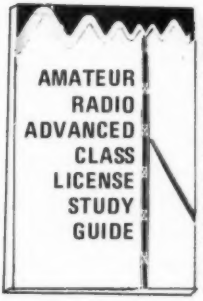

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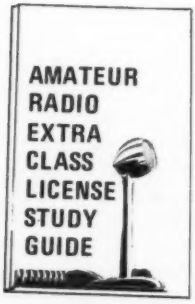

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Microwaves

The microwave news this month revolves around a letter sent by Dean Lewis (WA1NOQ) describing a series of commercially available Gunn Oscillators that appear to be cheap, cheap, cheap to make.

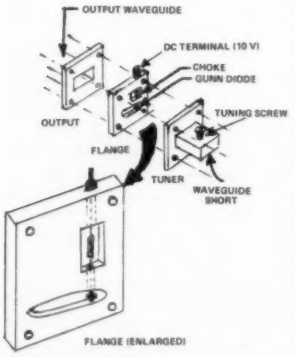
Before describing the Gunn oscillator, perhaps it would be of some interest to define exactly what we mean by a "Gunn" oscillator, or an "Impatt" oscillator. In fact, perhaps this is as good a time as any to make a small comparison between the microwave power generating diodes.

Bulk-Effect Diodes

The bulk-effect devices, made primarily from Gallium arsenide (GaAs) – because silicon and germanium won't work – are divided into two major categories: Gunn devices and limited supercharge accumulation (LSA) devices.

Gunn diodes, invented by J. B. Gunn of IBM in 1963, make use of the fact that a microwave oscillation will "ripple" through the entire semiconductor, much as a wave ripples across a swimming pool. Placing a voltage source across the diode causes these ripples to build up in amplitude until a large useful oscillation results. Voltages required for these devices are low (less than 15V) and are applied in the forward direction at currents up to one ampere. Output powers are from one watt at C band to ½ watt at K band. This is CW power.

LSA devices operate at lower frequencies (L band), higher voltages (up to 1 kV) and higher PULSE power output (2 kW), but do not operate in the CW mode. They were invented in 1967 by John Copeland of Bell Labs. Although they will work well into L-band, they are much more efficient at 8 GHz and above.



Avalanche Diodes

The avalanche devices make use of the fact that a reverse biased diode will reach a certain point where the current will increase astronomically for a small increase in reverse voltage. Some people call this the zenering point, and have noticed that diodes used as zeners generate noise. This "noise" is actually oscillation in the avalanche mode. There are two main modes of avalanche oscillation: Impatt and Trappat.

Impatt (IMPact Avalanche Transit Time) diodes operate on the principle of drift across the reverse biased junction. The time necessary for a particle to cross the junction is the so called transit time, and hence the name Impatt. These particles give rise to a negative resistance characteristic, and hence may be used as amplifiers or oscillators. Impatt devices operate from about 100 volts, and put out oscillator powers (CW) of one watt at S band, rising to 3 watts at X band. Pulse powers of 10 watts and X band and 5 watts at K band have been reported.

Trapatt (TRApped Plasma Avalanche Triggered Transit) diodes typically operate at 1/3 the frequency and 3 times the efficiency of IMpatt devices. In the trapatt, instead of the normal zenering action, a plasma is actually formed which supports the oscillation. CW output powers of 10 watts at 1 GHz and 2 watts at S band have been recorded.

Now, what Dean Lewis sent me was the method used by Fairchild and Microwave Associates to get powers of 50 milliwatts or so by means of a Gunn flange oscillator. These oscillators are meant for low power transmitters and local oscillators in superheterodyne receivers, and are quite adaptable to amateur X band. (For an excellent set of references see: *Electronics* magazine, 1 March 1971, the Fairchild data sheet, "Go(x)-100 Series X-band Gunn Flange" November 1970, and Gunn Diode Circuit Handbook by the Microwave Associates people, February 1971.) The machining necessary to build one of these devices is extremely simple (see sketch) and should be well within the capabilities of most microwave amateurs. The only trouble is the cost of the Gunn diodes. The industrial net price in onesey-twoseys is still around fifty bucks. Hey, how about some of you scroungers digging up a good, cheap source of Gunn diodes. If you dig up a few or a few hundred, I'll be glad to come up with an article for *73* with complete construction details for this particular diode. Until then.

Jim Weir WB6BHI
P.O. Box 23233
San Diego, CA 92123

MARS

Say, Oldtimer, do you remember the good old days when hams were a friendly, happy, extroverted bunch? Remember when you would attend a club meeting or a hamfest, and fellowship would be boiling over everywhere? When you knew every ham in the entire area, and all it took to get a coffee klatch going was a flip of a switch and a couple of words into the mike? Or when you would join a half-dozen friends on a Saturday morning to help some fellow put up a better or higher antenna? Do you recall being saddened when a fellow ham suffered an illness or a reverse, or rejoicing with him in his triumphs? Do you remember when becoming a ham made you a member of a very special fraternity with an informal motto of "All For One and One For All!"

Hello, young man! So you're a brand new ham, huh? Gee, I'll bet you are proud of that ticket! I notice you are sort of wandering around all alone – where are all your friends? Oh, you don't know any other hams except on the air! Do you wonder how you can break into that loudmouthed group having so much fun over there? You say you haven't been able to find any members of that happy, unselfish group that you have always heard made up the wonderful amateur radio fraternity?

Well, here s news for both of you! That fraternity which you so fervently seek is alive and doing well! You haven't been able to find it, simply because the particular type of ham that makes up the majority of such a group moved off the ham bands and is now operating as a member of the Military Affilitate Radio System – MARS!

It s not that these people are no longer hams – heaven forbid! They are still interested and active in all facets of ham radio – it s just that they have banded together with others who have similar interests, such as emergency communications, handling moralle-type messages or phone patches from overseas military personnel, while at the same time learning to be rapid, efficient communicators, and having a ball on the military two meter repeaters!

The MARS membership includes teenagers and octogenarians, generals and privates, housewives and career girls – people from all walks and economic strata, bound together by a simple and sincere love of the MARS way of life. Nor is ours a static (sorry

(continued on page 146)

50 MHz BAND

Bill Turner WAØABI
5 Chestnut Court
St. Peters MO 63376

VE4 "Morning After" has been joined by VE4 "Morning Prior," both from Winnipeg. Mike runs a modified SB-100. Welcome to 6, Mike – very pleased to be your first contact. Another VE4 heard for the first time from this QTH, is VE4YW.

VP5RS was worked immediately following the above contact with the beam still north. Signals were 5-9 in that direction, climbing to 25 over when the beam heading was optimized. Bob reported 550 contacts during the first 50 hours of operation. Arizona was the best DX to that time. This station made contact four of the first five days of operation, but signals never again approached the level of the first day. Thanks are due to Bob, Hoppy and Joe, as well as Bert and Tex of XE2XN and Allan 9P63N, for providing a little spice to what in this area, at least, was a rather blah contest week end. It is understood that Allen is to be a permanent fixture on Barbados, has a code wheel going, and may be expected to supply many interesting contacts in the future.

In connection with the above, split frequency operation is difficult for the transceiver owner, but there is a way around this if the rig is an SB-110 and there is another SB series rig in the shack (100–300–400). A short length of RG 174/U with a phono connector on one end is plugged into the LMO of the low band rig. The opposite end is connected to ground and the coax removed from the PC board pad which forms the junction of C38 and C39. After this installation it is possible to transceive on either LMO or operate split frequency using the internal LMO for receive and the low band LMO for transmit. Plugging the LMO into the crystal socket or the crystal oscillator grid and ground will not work. The rotation direction in the low band LMO is reversed, making it necessary to tune backwards (50.110 is .390 on the LMO dial.)

Numerous reports this month of KL7 contacts from the west and southwest – calls mentioned include KL7GFB, KL7GLL KL7HIF, and K7WXW/KL7. KL7DFE was also mentioned, but I suspect this is a misunderstanding. GFB and DFE sound very much alike. W4GDS finally QSO'ed a VE7. Bob needs only KH6 and KL7 for WAS. A number of California stations made the WAS list by contacting Art, WA1EXN, of Maine. Dave WA7JEI tells me he worked PY9GM on CW May 27th with 3-3-9/4-4-9 reports exhcanged. K4RNG, the only rebel from Ohio, is back on the air on a limited basis. I am sure friends all over the country wish Les a speedy and complete recovery. Six meters hasn't been the same without him. VE5US remains active with Doug doing most of the mic work. SYL is still around but deeply involved in other projects and not getting on the air much.

WAØTXV points out something which is obvious yet commonplace. Bob mentioned the practice of many working scatter during the contest to repeat the callsign of the called station over and over again after the effort to pass information was under way. As Bob says, "The station called knows his callsign, he wants to know yours." To this I would add the advisability of always *calling* on the same frequency (except in the case of QRM) during skip and scatter operation. All too often you hear a signal, get a portion of a callsign and are waiting for a QSO to end or for an opportune moment, only to have the signal disappear completely. After waiting for a period of time and not hearing anything further, you tune a little and discover the desired station up or down the band, then the whole procedure starts over. Tune if you will, but return to the same frequency to call and you will receive greater benefits for the hours spent.

On the 27th of May, while in QSO with WB4WXZ, "VUQ9W" joined in. His conversation, as relayed by Dave, consisted of the information that he was located on an island off Australia so small there was no callbook listing. The transmitter was 5 watts AM, solar battery powered because there was no source of commercial power available. It was stated that no QSL should be sent because there were only two mail deliveries per year. "John" was coming home in five months and would at that time contact all stations worked. Over the period of the next hour and a half or so, this station made numerous contacts with Florida stations, all strangely reporting 5-9 signals with their beams North. There must be a truly bright moon over the South Pacific! I trust the FCC noted the striking similarity in callsign to that of a well-known SSB hater in the north-central area.

Many thanks to those who included an SASE with their request for the list of TV manufacturers who supply TVI filters or help on problems related to 50 MHz operation. It has been a pleasure corresponding with many of you and I hope it has been worth while from your viewpoint, too. As always, activity reports, questions about 6 meters, TVI problems, and what have you, are welcome .

73 . . . WAØABI

DX WORD GAME

Buried in the maze below are the names of at least one hundred "good" DX countries. The names may read forward, backward, up, down and diagonally. A letter may be used in more than one name. How many can you find?

A	U	S	T	R	A	L	I	A	N	O	W	J	I	S	H	T	E	C	N	A	R	F	T	I	M	P	E	C	F	O
R	F	R	A	L	L	A	Y	N	E	K	R	A	M	N	E	D	H	G	O	I	T	I	A	H	O	E	A	D	A	
G	M	G	H	A	N	A	E	A	U	N	M	A	L	G	E	R	I	A	N	T	O	C	I	O	Y	I	M	M	I	
E	E	M	H	N	T	O	H	W	T	E	E	U	E	A	I	S	N	L	D	O	F	L	T	L	P	O	E	H	D	
N	R	O	D	A	V	L	A	S	L	E	X	E	B	R	O	D	A	U	C	E	I	I	O	O	D	R	R	P	O	
T	A	R	R	T	N	I	T	T	Y	E	I	T	A	M	A	N	A	P	H	P	E	N	I	G	Q	U	O	I	Z	
I	R	O	C	U	T	I	K	O	M	B	C	A	N	A	D	A	R	O	P	W	N	H	N	F	O	X	O	J	M	
N	O	C	U	H	M	O	S	B	P	T	O	I	O	E	D	L	O	I	V	A	T	I	A	L	B	A	N	I	A	
A	B	C	E	B	H	R	O	T	T	H	E	S	N	E	L	R	N	A	Z	E	K	A	I	B	M	U	L	O	C	
Y	E	O	G	T	B	U	R	M	A	O	R	E	A	C	Y	E	D	G	O	D	R	I	B	U	R	U	N	D	I	
O	R	B	O	E	R	T	H	A	Y	N	G	D	L	E	S	H	L	N	E	I	C	K	S	W	E	D	E	N	R	
E	T	S	L	G	I	N	C	S	B	I	N	O	T	E	Y	T	O	T	F	L	A	G	U	T	R	O	P	D	A	
B	E	L	G	I	U	M	F	U	I	A	U	H	T	R	O	E	I	U	R	S	C	O	O	R	A	E	A	N	T	
L	A	G	E	N	E	S	E	D	L	A	I	R	E	G	I	N	I	G	E	R	G	O	C	O	U	N	D	D	S	
I	N	D	T	E	N	W	Y	A	A	D	R	S	E	A	U	N	I	T	E	D	S	T	A	T	E	S	N	R	O	
B	I	F	O	R	C	A	E	N	E	N	D	L	A	P	E	N	O	R	W	A	Y	F	N	A	T	A	A	H	C	
E	C	S	W	I	T	Z	E	R	L	A	N	D	E	R	S	I	I	B	R	O	R	E	O	U	L	G	L	H	G	
R	K	T	F	O	W	I	E	R	H	W	T	H	O	N	T	C	A	T	I	J	I	F	M	O	A	L	E	L	U	
I	E	M	E	E	N	L	A	C	R	R	A	C	I	A	M	A	J	E	E	C	A	S	P	A	I	N	R	E	A	
A	L	T	N	E	D	A	E	G	H	U	B	U	L	G	A	R	I	A	A	D	L	W	E	P	N	H	I	O	T	
Y	Y	Y	R	A	G	N	U	H	H	O	E	Y	E	S	N	A	D	R	O	J	A	P	A	N	A	T	R	U	E	
U	E	L	D	I	N	D	T	V	T	H	S	S	T	O	B	G	E	S	E	L	F	R	Y	E	M	E	N	E	M	
G	K	C	U	B	A	D	E	I	V	N	D	L	E	N	T	U	N	I	S	I	A	T	A	U	O	N	I	T	A	
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A	M	E	U	R	W	O	R	I	L	A	D	G	A	B	C	K	Y	L	S	H	A	L	R	I	L	R	P	O	A	
V	U	E	L	I	H	C	M	D	S	I	V	U	A	A	N	D	I	T	K	R	I	E	I	V	S	S	H	N	Y	
I	L	A	M	A	B	H	O	N	D	U	R	A	S	O	U	T	H	A	F	R	I	C	A	I	O	T	H	C	U	
A	L	S	E	N	O	D	N	I	V	O	R	Y	C	O	A	S	T	A	T	S	B	I	U	A	E	N	I	U	G	

(For our best effort, see page 86)

AMSAT NEWS

Michael Frye WB8LBP
640 Deauville Dr.
Dayton OH 45429

When Oscar 6 is launched many amateurs will want to process the Morse code telemetry data coming from the satellite. This can be done in a number of ways, first the code could be copied down by hand, but this is a tedious and time consuming process. A much better way is to use a Morse code to teletype converter. Then feed this into some form of home brew computer. With the proper program the data could be printed out in engineering form, such as volts, amps, degrees centigrade, etc. The results could then be sent to AMSAT (PO Box 27, Washington DC 20044) either by mail or over one of the HF radio links.

A-O-C when in orbit will be identified by a Morse beacon sending the letters HI (. . . . .). This will precede and end each telemetry transmission, so that telemetry or CODESTORE information will be easily recognizable. The beacon will operate on 29.45 MHz within the repeater passband and will have an expected output of 0.2 watts.

CODESTORE

CODESTORE is a Morse code message storing system. It is a static shift register memory which is loaded from the ground through the AMSAT command network. After loading CODESTORE will repeat the same message until changed by ground command. CODESTORE will operate on the 29.45 MHz CW beacon. The memory length of A-O-C's CODESTORE is 768 bits, this is sufficient to permit storage of approximately 15 words in Morse code. The device is set to retransmit messages at 13.4 wpm, at this speed teletype characters can be recorded in CODESTORE and retransmitted to the ground at one-quarter standard 60 wpm teletype speed. To decode the teletype, one need only to tape record the message at 1-7/8 ips and play it into a teletype system at 7-1/2 ips. It will be entirely possible to store teletype messages up to 96 characters long by this method. A good example of the use of CODESTORE is shown in the following message: "orbit number 2109 had an ascending mode equatorial crossing at 1101GMT at 101 degrees west longitude. For later orbits add 115.113 minutes to the time and 27.781 degrees to the longitude per orbit." This would be read as: "ORBIT 2109 1101Z at 101W ADD 115.113 MIN AND 27R781 DEG PER ORBIT." In addition, emergency and request messages can also provide CODESTORE with many uses.

A Morse beacon operating on 435.10 MHz is also planned for A-O C. If it's completed in time it too will be used for telemetry or CODESTORE CW transmissions.

MARS *(continued from page 144)*

about that!) organization – our membership includes some of the finest technical brains to be found anywhere! Example: Third US Army MARS owns the world's entire supply of 2300 MHz moon-bounce operators – A4HHK and AA4RJ! Army MARS became operational in February, 1948. In order to keep the organization abreast of the times and state-of-the-art, periodic meetings and conferences are held at all levels where problems are outlined and solutions offered. Such a conference was recently held in Washington – and attended by *every* Command MARS Director in the United States, Europe, Asia and the Pacific!

If you are still not convinced that such an organization exists, that there is such camaraderie, fellowship and goodwill, just walk over to the MARS meeting being held at the next hamfest you attend – you will be welcomed! How can you become a part of this outstanding ham organization? Simply address a card, letter or radio message to:

Harry Simpson A4SCF
c/o 73 Magazine
Peterborough, NH 03458

THE TRAVELING HAM

OR, THERE'S MORE THAN ONE WAY TO GET A QSL CARD

Richard Musicer WB6URS
11970 Montana Avenue
Los Angeles, CA 90049

There is no need to tell those of you who travel overseas the advantages of being a ham. If you haven't yet been abroad, let it suffice to say that the enjoyment and education provided by any trip can be multiplied many times over by eye-ball QSOing with hams of other countries. However, there are important do's and don'ts when attempting to meet our foreign brethren. If you follow the following suggestions I've carefully outlined, your chances of a successful encounter will be much greater.

Once you have selected your itinerary, turn on the rig (no, not the one with the channel selector, the one with the VFO) about a month or two before departure. Look for hams in the countries you want to visit and tell them that you are planning a visit to their country on such and such date. Don't push them, but if they seem interested in meeting you, ask for their phone number, both at their home and where they work. Most will be very pleased at the suggestion. Keep in mind that no one is better qualified to suggest hotels and restaurants than these hams (but tell them what kind of accommodations you are used to). Also, you might ask them when their local radio clubs hold their meetings. Often they are weekly rather than monthly and you may wish to rearrange your itinerary slightly so that you can attend. This is a good way to meet many hams in a short time as well as an interesting way to hear their problems, which usually are very different from ours. (I don't remember one African club ever once mention TVI!) Say 73 and keep tuning – don't stop with one ham. It wouldn't be the first time to happen if you find your DX friend "out of town," etc. when you reach your destination.

After your suitcase is all packed (I hope you haven't shut it yet), here's what to throw in on top of your nicely folded coat. (If the XYL complains about the weight, take one of her five pairs of shoes out.) Your bible on the trip will be a recent foreign Callbook. (Nothing is more exasperating than to find that no one in your 1962 issue is to be found in the local phone directory when you arrive.) Throw in some of your nicer QSL cards and bring along some new commemorative U.S. stamps – you'd be surprised how many foreign hams collect them. Do not bring your ham rig. It's too big, too heavy, and your crummy portable dipole won't work anyway. Use your new DX friend's rig and beam when you visit his QTH. In addition, you'll never clear your equipment through customs in many countries, especially in Africa and the Far East. (In this article I won't tell you about the conversion from Drake transceiver to Sony FM Stereo where the plate load and tune become the bass and treble controls, and the mic gain turns into a balance control, etc. . .) Only schlepp parts if someone specifically asks you to.

If you already have phone numbers when you arrive, your job will be much easier. Just make the call (be patient with their phone service – it won't be like ours) and introduce yourself. However, please note that

(continued on page 148)

ELECTRONIC SURPLUS BARGAINS

KLEINSCHMIDT TELETYPEWRITERS

Model TT-98/FG & TT-100/FG

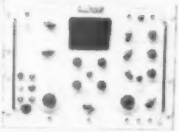
Capable of sending 60-100 WPM, 115v., 60 cyc. Self contained power supply, Shipping weight - 70 lbs ..... **$59.50 ea.**

Model TT-117/FG same as above except no power supply. This unit used with Model TT179/FG Reperforator-Transmitter which contains the power supply for both units $49.50

TELETYPEWRITER TABLES

Heavy duty construction, shpg. wt. 20 lbs. for page printer, 22" x 18" x 27" ht. $15.95

OSCILLOSCOPE

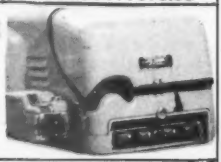


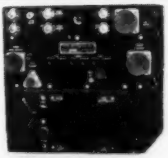
A widerange, high gain, portable test unit for observation of pulses, short-period electrical disturbances, sine waves, Band width 3 cyc.-15 mc. 105/125 VAC, 50-1000 cyc. **AN/USM50 . . . $79.00**

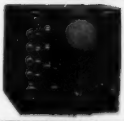
REPERFORATOR-TRANSMITTER

Model TT-179/FG Mfg by Kleinschmidt

Tape printing & punching, also transmitter-distributor, 115 volts, 60 cyc. shpg. wt. 90 lbs. Used, excellent cond., (gov't cost $2,000) $59.50



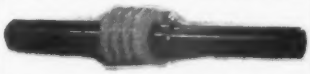




AN/APN-12 RADAR SET

Consists of rec.-trans. RT11-A and ID-169 indicator. The transmitter interrogates a remote radar beacon by pulse type RF signal, pulse reply from beacon is received and displayed on the indicator to show distance and left or right heading for homing to location of remote beacon. The rec.-trans. contains 1-24 V.D.C. gear-head motor, 1-blower and tubes: 2 x 2, 2C26A, 9002, 5R4GY, 6SN7GT, 6V6, 6E5, 2-6SL7GT, 2-6AK5, 6-6AC7. Indicator contains motorized coaxial switch and tubes: 3BPL-C.R.T., 6AS6, 6AQ5, 6 x 4, 2-5726, 5-12AU7. Power reqmt. 115 V.A.C. 400 cy. and 24 V.D.C. freq. range 160-240 MHz. Rec.-trans. shpg. wt. 50# $18.95
Indicator shpg. wt. 35# $14.95

VERTICAL ANTENNA INSULATOR



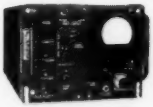
TOP - 1 3/8" o.d. - bottom 1 3/8" i.d. 16½" long - Shpg. wt. 8#$4.50 ea.

Volt and ammeters Many types and styles

T-142/ART-13 Transmitter

This unit is ideal for HAM use on 80, 40, 20 and 10 meters. It has a power output of 100 Watts, AM, CW and MCW in a freq. range of 2-18 MHz and can be preset to the desired frequencies on any of 10 preselected channels. Complete with oscillator, 12" x 16' x 24", shpg. wt. 75# $49.50

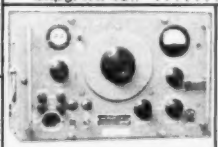
PANORAMICRECEIVER



R356/ARR-8 290-520 MHz Tuning range in 2 bands – Directly covers 420–450 MHz Ham-band, AM. Contains 5 stage, 52 MHz I F Amp, power supply module, tuner with motor driven sweep capacitor, 2 mixer sections, 2-R.F. pre-amps and tubes: 3JP1 – C.R.T., 1B3, OA2, 6AK5, 5654, 6096, 6097, 5Y3, 2-6AK6, 2-6AL5W. Power input 115V. 400 cy. Also available 70-300 MHz and 730-960 MHz. Excellent conditon. Shpg. wt. 40# $18.95

FLYING HELMET

Fiberglass shell with retractable shaded visor. boom type carbon microphone and earphone headset. Use in car, plane, boat, motorcycle, used. $15.50



AUDIO OSCILLATOR

TS-382, 20 CPS-200KC, variable 0-10 volts, power input-115 VAC, 60 cycle. 17" x 10" x 11". Shpg. wt. 65# used, good cond. . . . $65.00

APN-9 LORAN

A receiver operating in the marine band to provide boats and aircraft with their exact position. Shpg. wt. 45# used. .$49.50

2-METERVHF BC-640 X'MITTER

50 watt - CW and AM. Freq. range 100-156 MC crystal controlled Pwr. rqmt. 100/125 60 cyc. Crated wt. 600 lbs. 6' x 22" wide. $49.50

ANDY ELECTRONICS 6427 Springer 713-645-7057 Houston, Texas 77017 Richard Hall – W5ZJG

(DIV. OF ANDY INTERNATIONAL, INC.) F.O.B. Houston, Tex. – Payment with order

TRAVELLING HAM

(cont. from page 146)

just because the ham speaks English on the air is no indication that his family also speaks English. Ask for your friend by name or try a key word like "radio" to make yourself understood. When you do reach the ham (don't give up, it might take awhile) tell him about your good impressions of his country and suggest you get together at your hotel for a drink. Don't expect him to rush over to pick you up and take you immediately to his shack. If all you want to do is just get on the air, the best line to use is "I have a schedule with stateside in a half hour and would it be possible for us to give it a try?" (I'll never forget a certain ZS2 who drove about ninety miles per hour down the wrong side of the road to avoid the traffic so I could meet my sked.)

If you arrive somewhere and have no phone numbers, it s time to break out the Callbook. If there aren't too many hams in the city of the country you are in (like ZD5 or VR4), than a quick check with the names in the local phone book will probably be useful. Usually the latest listings, those at the end of the list, will be the newest and most active hams and the most receptive to visitors. Call them first. Those at the beginning of the list (ZX2AA, ZX2BB) are usually not very active, are old, and tired of visitors, but they may know the newer hams and how to reach them. In large cities, the local radio clubs are often listed and can give you phone numbers and addresses of hams. A good example of this is the WIA in the major cities in Australia. The Sydney branch is especially helpful in locating people. In more remote countries go to the local telecommunications office since they are usually the licensing authorities and often know who is active.

If all else fails, use your eyes. When you are in a taxi or on a tour bus, always look up. I have met many people both in large cities and in small VK9 villages by the old "bang-on-the-door" technique. These people are often the friendliest of all and will really go out of their way for you. T'ie surprise factor is always fun, too.

There is a general rule to figure out how receptive hams in given countries will be to foreign visitors. When there are not many hams and a great number tourists, you can expect a lot of door slamming, not answering the phone, and disconnected doorbells. A good example of this case is Greece (Athens) or Fiji. If there are not many visitors, but lots of hams, expect the royal treatment. This applies to most of the larger African cities like Johannesburg and Salisbury. If there are very many hams and also a large number of visitors, you will still have an enjoyable time. This applies to Japan and Australia. In the case of countries where there are only one or two hams, but very few visitors (i.e., VR4, ZD5, VK9), you will probably enjoy yourself the most. Usually the hams in these places are the nicest you'll meet anywhere since they generally have much free time with little outside pressures or excitement which means that your arrival merits more attention. Needless to say, it's also more fun to get on the air from these places.

As a final hint, never expect anyone to do anything for you – you'll be much happier this way. And if nothing else, remember that you are the guest in any other country, and that when you travel you are your country's number one ambassador to the people you meet. Your actions, courtesy, and politeness reflect on every one of your countrymen and if you act like you do in a pile-up, you'll hear your friend in the foreign, and not in the American phone band. Have a good time!

EVER HAVE A DREAM COME TRUE?

Sheldon K. Davis
98 Rex Avenue
Indiana, PA

Since Indiana, Pennsylvania is known as the "Christmas Tree Capital of the World" I have often thought how great it would be if there were a call available with the word TREE in it. Then along came the FCC with their special call signs.

I planted and nurtured the idea of the special event call of WT3REE in many club meetings – and suddenly it bore fruit! Helpers and club sponsorship were obtained.

The next hurdle was the FCC and their permission. Letters and phone calls established the fact that such special calls were getting harder to get. But – our request was a little unique – so permission to use it for four days in May to coincide with our local Christmas Tree Candlestick Festival.

Why a Christmas tree celebration in May? Easy! It's too cold in December. In addition, we are too busy cutting and shipping nearly a million plantation grown Christmas trees for shipment all over the world. In the merry month of May, the new growth on the evergreen trees resembles "candles" on the boughs. So the local leaders elect a Queen Evergreen, invite commercial exhibitors, local service clubs and others to get activities and ideas that will help separate the tourist from his hard earned buck.

It works too. About 20,000 people attend, eat hot dogs and pancakes, view stage shows and take tours of the "tree farms." About 400 campers used the event for a "camp-in."

Our local radio club borrowed a crank-up trailer from a dealer, scrounged up a big tent, set up rigs, made signs and handouts, put up antennas and were in operation WT3REE caper. Of course "little" things like hassles with the electric company about power. Oh they were willing, and even ran power to the top of an adjacent pole. But we couldn't get together with proper safe and acceptable material for the "bottom" of the pole. Ham ingenuity came through, though. All rigs and lights were operated from one little light socket in an unused ticket booth nearby (which permission was also hard to come by!) Antennas were strung up with the usual fun and havoc. They even worked – mostly!

Operators were easy to come by – at convenient times and with competition from a hamfest. Fortunately, a dedicated few braved the wee hours to make over 600 contacts in 24 states and Canada. Many listeners failed to see the TREE in the call WT3REE – but were happy to get the special contact anyway. Many more contacts might have been made but much rag-chewing went on both on CW and phone. But then again, that was the real purpose: to publicize the county and its tree industry!

Comes now the battle of the QSLs. The local Tourist Promotion Bureau is helping with the cost of the cards – but someone has to sit down and fill them out. A SASE was requested but some failed to get the message. We

(continued on page 150)

50 MEGAHERTZ LOW COST COUNTER

Here is a new item, featured because of numerous customer suggestions. We have taken the basic power supply, chassis and cover from our clock kit, and by substituting a new front panel and printed circuit board, have made a lowest cost frequency counter. The unbelievable low cost is due to our use of our large stock of unused surplus parts, the new 74196 50 MHz decade counter, and the commonality of parts with our other kits. Readout is to six decades, time base is 1 second, 0.1 seconds, or external. Design is modular, for ease of construction, compactness, and expandability.

- ☐ 50 MHz six digit counter, using line frequency as time base, complete except for cover $97.50
- Optional crystal controlled time base plug-in conversion $23.50
- ☐ Cover, blue or black anodized . . . . . $ 4.50

BUILD YOUR OWN ELECTRONIC CALCULATOR FOR ONLY $108.00!

A complete calculator kit, complete with self contained power supply and case. Indispensible in the home, office or school. Simple enough for a child to build. Some of the features of the calculator are as follows:

- MOS integrated circuits (extra large scale integration) reduce the number of components to a minimum, for easy assembly. • Displays eight digits on large size seven segment displays. • Full function complement keyboard features addition, subtraction, multiplication, division, alternate constant, clear on, clear entry, and decimal point set. • Sixteen digit entry and sixteen digit results are possible with alternate display key. • Leading zeroes suppressed • Chain operation • All integrated circuits and displays are socket mounted and replaceable.

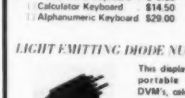
So reliable and simple to build, we can make this guarantee: If for any reason you cannot succeed in getting your calculator to function properly after completing construction, for a flat handling fee of $10.00, B and F will repair and ship back your calculator anywhere in the USA. This applies regardless of the age of the assembler, barring gross negligence or the use of acid core solder in construction.

DIGITAL CLOCK KIT WITH NIXIE DISPLAY

We have well over 20,000 surplus neons in stock and because of this bargain purchase we can sell a complete digital clock kit for less than the usual cost of the display tubes only. We provide a complete etched and thru-plated circuit board, all integrated circuits, complete power supply, display tubes, I.C. sockets and a nice front panel with polaroid visor. We have never seen anyone offer this kit for less than $100.00 before. Includes BCD outputs for use as with timer option. May be wired for 12 or 24 hour display. Indicates hours, minutes, seconds.

- Clock Kit, complete less outside cover $57.50
- Aluminum blue or black anodized cover (specify) . . . $ 4.50
- ☐ **SHRINK TUBING SPECIAL.** Assortment of 200 pieces of shrink tubing, diameters 1/8" to 1/2", length 1/2" to 2" . $1.25
- Price $1.25

KEYBOARDS



Three keyboards are available; 20 key calculator keyboard, 40 key alphanumeric, , and 12 key touch tone. All have separate contacts carried out to edge connector.

- ☐ Touch Tone Keyboard . . $ 9.95
- ☐ Calculator Keyboard . . $14.50
- ☐ Alphanumeric Keyboard $29.00

LIGHT EMITTING DIODE NUMERIC DISPLAY

This display is excellent for small portable electronics, such as DVM's, calculators, etc. Equivalent to Montsanto MAN 3A. Operates from 5 volts, 20 milliampers, with 47 ohm dropping resistor.

$3.25 Each

10 For $27.50

- ☐ Complete counter kit, **7400, 7475** latch **7447**, printed circuit board, led readout . . . $9.50

LATEST HARD-TO-GET SEMICONDUCTORS

- ☐ MUS 4988 silicon uni-lateral switch. Useful for voltage sensitive switch, sweep generators, etc. $1.00
- ☐ MIS A64 PNP high current Darlington transistor. Super high gain in small package . . . . . 2/$1.00
- ☐ MPS A14, same as above, NPN . . . . . 2/$1.00

THIS MONTHS FEATURE ITEM

POCKET CALCULATOR KIT

This is the kit you have been waiting for. So compact it actually fits in a shirt pocket (3 13/16 x 4 5/8 x 1 1/4). It performs every function you would expect in a desk calculator, including constant and chain operation, and full floating decimal. The unit is powered by self contained batteries, and uses 8 digit LED displays. The calculations are performed by a single 40 pin integrated circuit, which can truly be called large scale integration (LSI).

As a student, engineer, salesman, accountant, or anyone who would like fast accurate answers, this calculator fills the bill, and at a price that unquestionably makes this the lowest price high quality calculator available.

- ☐ Pocket Calculator Kit $75.00

RECHARGEABLE BATTERY/CHARGER KIT

This option allows the throw-away alkiline battery to be replaced with a nicad battery, and includes a charger to recharge this battery. The unit may be run during the recharge cycle.

- ☐ Battery/Charger Kit $17.50

LOGIC AND OPERATIONAL AMP' SUPPLIES

- ☐ Figure A, potted logic supply, 5 Volts at 1 Ampere, short circuit proof, ultra high regulation, ultra low ripple $16.00
- ☐ Figure A, potted Op Amp supply, +15 Volts, and -15 Volts at 0.5 Amperes. Mfg. by Analog Devices, similar to their model 902. Short circuit proof, ultra high performance $29.00
- ☐ Figure B, 5 Volt 1 Amp supply, regulated by Fairchild 9305, short circuit protected. $9.75
- ☐ Same as above, in kit form $7.75
- ☐ Mating connector for above $1.00
- ☐ 5 Volt 5 Amp regulated supply, by Blulyne. (not shown) $29.00

LIGHT EMITTING DIODES

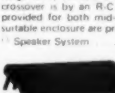
Montsanto MV 50 or equivalent LED's. Now less expensive than filamentary bulbs. At this price wire them into logic circuits as status indicators, build low cost counters or use them as panel lites. Rated at 10 - 40 Ma @2V.

- 10 LED's $3.00
- 100 LED's $25.00
- 1000 LED's $200.00

LOUDSPEAKER SYSTEM COMPONENT SPECIAL!!

We have made an excellent purchase of an excess inventory of a local manufacturers speaker systems, although we aren't allowed to mention the manufacturers name, the specs should make it self evident. The woofer is a 12" free edge (acoustic suspension) unit, with 2" voice coil and a 2 lb. magnet. The mid-range is a 5" unit and the tweeter is of the dome type, for best high frequency dispersion. Crossover between woofer and mid-range is by an R-L-C network, while high frequency crossover is by an R-C network. Balance controls are provided for both mid-range and tweeter. Plans for a suitable enclosure are provided.

- ☐ Speaker System . . . . . $29.00 ea./2 for $55.00



CALCULATOR CHIP SPECIAL

B and F has purchased a quantity of MOS large scale integration chips for calculators. We are not allowed to mention the manufacturers name, however, the specs should make them self-evident.

- ☐ Set "X" - Four 24 pin I.C.'s, BCD output, 16 digit, fixed automatic decimal point, possible memory expansion, constant $29.00
- ☐ Set "Y" - Single 40 pin, 7 segment output, 12 digit, fixed automatic decimal, no constant . . . $15.00
- ☐ Set "Z" - Single 40 pin I.C., 7 segment output, 8 digit, floating point, constant $19.50

LINEAR DEVICES, OP AMPS, REGULATORS

- ☐ **709 High performance Op Amp** . . . . . $.50
- ☐ **711 Dual Comparator** . . . . . $.50
- ☐ **723 Regulator** $1.25
- ☐ **741 Compensated Op Amp.** . . . . . $.50
- ☐ **558 Dual 741** $1.00
- ☐ **LM309 5 Volt 1 amp Regulator, TO-3** $2.25

FAIRCHILD VOLTAGE REGULATOR

Fairchild UGH7805 5 Volt 1 amp voltage regulator. Perfect for logic supplies, very compart $1.95

SANKEN HYBRID AUDIO AMPLIFIER MODULES

We have made a fortunate purchase of Sanken Audio Amplifier Hybrid Modules. With these you can build your own audio amplifiers at less than the price of discrete components. Just add a power supply, and a chassis to act as a heat sink. Brand new units, in original boxes, guaranteed by B and F. Sanken and the Sanken U.S. distributor. Available in three sizes: 10 watts RMS (20 watts music power), 25 watts RMS (50 watts M.P.) and 50 watts RMS (100 watts M.P.) per channel. 20 page manufacturers instruction book included. Sanken amplifiers have proved so simple and reliable, that they are being used for industrial applications, such as servo amplifiers and wide band laboratory amplifiers.

- ☐ **SI1010Y** 10 watt RMS amplifier, industrial grade **$4.75**
- ☐ **SI1025A** 25 watt RMS amplifier, industrial grade **$14.75**
- ☐ **SI1050A** 50 watt RMS amplifier, industrial grade **$22.50**
- ☐ **SI1025E** 25 watt RMS amplifier, entertainment grade **$14.00**
- ☐ **SI1050E** 50 watt RMS amplifier, entertainment grade **$21.00**
- ☐ **Transformer** for stereo 10 watt amplifiers (2 lbs.) $3.95
- ☐ **Transformer** for stereo 25 or 50 watt amplifiers (5 lbs.) $5.95
- ☐ **Set of (3) 2000 mfd 50V capacitors** for 10 watt stereo. $4.00
- ☐ **Set of (3) 2200 mfd 75V capacitors** for 25 or 50 watt amplifiers . . $5.00
- ☐ **6 Amp Bridge Rectifier, suitable** for all amplifiers $2.00
- ☐ **Complete kit for 100 watt RMS stereo amplifier (200 watt music) including two 50 watt Sanken hybrids, all parts, instructions, and nice 1/16" thick black anodized and punched chassis** **$88.00**
- ☐ **Same for 50 watt RMS stereo amplifier, includes two 25 watt Sankens, etc.** **$58.00**
- ☐ **Same for 20 watt RMS stereo, includes two 10 watt Sankens, etc.** **$30.00**

SGS TAA 621 AUDIO AMPLIFIER

I.C. audio amplifier in 14 pin DIP package, provides up to 4 watts power with proper heat sink, and 28 Volt supply. Can be used at 12 Volts with reduced output power. $1.95 6 for $10.00

HIGH POWER SCR's

SCR's - invaluable for high power applications, motor speed controls, lighting circuits, welding controls, etc. Never before at this low price. Brand new packaged devices, complete with data sheet and 24 page consumer applications manual.

☐ **2N5062**	**Plastic 100V 1 amp**	**$.35**
☐ **2N5064**	**Plastic 200V 1 amp**	**.40**
☐ **2N4169**	**100V/8 amp stud**	**1.45**
☐ **2N4170**	**200V/8 amp stud**	**1.65**
☐ **2N4172**	**400V/8 amp stud**	**1.95**
☐ **2N3525**	**400V/3 amp press fit**	**.95**
☐ **2N1772/C15A**	**100V/8 amp stud**	**1.75**
☐ **2N1774/C15B**	**200V/8 amp stud**	**1.95**
☐ **2N1777/C15D**	**400V/8 amp stud**	**2.50**
☐ **2N1844/C20A**	**100V/12 amp stud**	**1.75**
☐ **2N1846/C20B**	**200V/12 amp stud**	**1.95**
☐ **2N5169**	**200V/20 amp stud**	**3.75**
☐ **2N5170**	**500V/20 amp stud**	**4.75**
☐ **2N5171**	**700V/20 amp stud**	**6.75**
☐ **2N3896/C30A**	**100V/25 amp stud**	**2.95**
☐ **2N3897/C30B**	**200V/25 amp stud**	**3.95**
☐ **2N3899/C30E**	**500V/25 amp stud**	**4.95**

SANKEN HIGH POWER, HIGH PERFORMANCE HYBRID VOLTAGE REGULATORS

These hybrid regulators are easy to use, requiring no external components. Excellent for operational amplifier supplies, logic supplies and other high performance applications. All regulators have less than 50 millivolts ripple and better than 1% line and load regulation, some models far exceeding this specification.

- ☐ **SI3120E 12 Volts, 1 Ampere** **$2.25**
- ☐ **SI3150E 15 Volts, 1 Ampere** **$2.25**
- ☐ **SI3240E 24 Volts, 1 Ampere** **$2.25**
- ☐ **SI3050E 5 Volts, 1 Ampere** **$2.25**
- ☐ **SI3554M 5 Volts, 3 Amperes** **$7.00**

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SSTV SCENE

It is really fascinating to see the programs some of the slow scan boys have worked up. Here one really has a chance to show originality. (Woe be unto us if K1YSD ever gets on slow scan!) Here's some thoughts to keep in mind when recording them when the band is dead and you have time. Try for the same audio level on all pictures. Clean the tape recorder heads (and de-magnetize if necessary) before starting to record. If you are using a battery operated recorder make sure fresh batteries are installed, or else, later when you install fresh batteries you'll pick up hum bars like in the June column picture. Also, make sure the slow scan system is properly calibrated; i.e., sync – 1200 Hz, black – 1500 and white – 2300 Hz. You might also check the 15 Hz horizontal sync rate (by reflecting a small amount of light from a lamp or VR tube onto the camera or phototube, or by pulling a ground on the video loose temporarily). Four vertical hum bars indicate 15 Hz. They tear to the right or left if the frequency is too high or too low. If you have Robot gear, turn the contrast to 9 o'clock and adjust the camera's controls to produce the best picture definition. This will assure maximum frequency deviation from the camera. A few minutes to check these few points will repay you ten-fold with quality pictures you'll enjoy sharing with other SSTV'ers for many times to come. And don't be afraid to splice pictures – they'll mate up quite easily with a little experience. Tapes not only provide a larger picture to time ratio, but they also free the camera and/or flying spot scanner for live relays.

I recently toured the radar facilities of an airport control tower, and a rather large ship. Those 14 and 16 inch P7 tubes really caught my eye. They also carry a few spares. A possible source of large screen P7s? Check around. . .they are more plentiful than the old 7290 slow scan vidicon.

Say, when are some of you YLs going to get on SSTV? If you think you rock pile-ups now with the feminine voice wait 'til you try slow scan and show yourself around. Gals are better to watch than receiver dials anytime! Come on – get "in" and on. . .SSTV.

The slow scan picture this month comes from Paulo, PY1DCB. This was sent from W6TEZ and was Paulo's first attempt at slow scan photography. Now he is in trouble with the XYL and wonders if anyone knows what magazine the pix was in. Sure that's not your next door neighbor, Paulo? Any rate, a very high resolution picture, with good gray scale and no QRM. You non-slow scanners – you are too close – hold the book at arm's length and look at the picture – don't read it.

Incidentally, a lot of fellows have been having a ball photographing pictures directly off the screen. This is most easily accomplished with a Polaroid camera (since the results can be seen immediately). Set the camera speed for a time exposure so when the shutter is opened it will stay open until you release it. A camera shop can make this modification if your camera doesn't have it. Openings of F4 or larger are sufficient for photographs with 4000 speed film. Place the camera squarely in front of the monitor (a tripod or stack of books may help) and open the shutter at a slow scan picture top, when you hear the vertical "blip," let the trace sweep down the screen its 8 seconds, then close it. (You did remove the yellow filter didn't you?) You will probably need to turn the brightness down, producing a dim picture on the screen, since the blue initial trace produces the picture on the film, and too bright a trace will "bloom" and not leave dark areas (washed out print). A close-up lens added to the camera will produce pictures almost as good as the ones on the screen, and will fill the photograph almost entirely. W4RKS made a nice monitor camera using an old Polaroid camera (lens swapped to 50mm, and refocused on film to produce close-ups) with a minibox bolted to the front. The minibox then fits onto the monitor firmly and the screen is viewed through a peep hole in the top. I believe Tectronics makes one like this, but the cost is around $300.

The other picture this month is from Franco, I1LCF and is a photo of the 1st prize of CQ Electtronica's slow scan contest, a Silver Thaler of Maria Theresa. It went to Don Miller, W9NTP. Congratulations Don!

Don't forget to drop me a card if you would like to see a U.S. Slow Scan contest this winter. These cards are our "poll" on how well the contest would be received.

. . .K4TWJ

EVER HAVE A DREAM COME TRUE?

(continued from page 148)

hope to QSL 100% with all contacts. I hope that patience is a virtue of all hams (it is isn't it?).

The outstanding event was a visit from Ann Parks, the newly elected Queen Evergreen IX to the ham shack. She had never heard of ham radio so was duly impressed and surprised to find herself in conversation with WB4OWW down in St. Petersburg, Florida. She mentioned that she had an uncle down there. At this point, Jim, WB4OWW, spent much time in tracking down the phone number of the elusive uncle.

Finally – the young lady jumped up and down with youthful joy and enthusiasm crying: "That's my Uncle Bob!"

And it sure was! The little Queen was able to tell her uncle of her election to Queen the night before. Both Jim and the local ops were proud and honored that we were able to make a little lady happy by her introduction to ham radio. Who knows: maybe a future YL op?

We made many mistakes – and many sins of omission! But we did make many contacts and helped many hams with a rare and exotic call sign. It is a great feeling to be on the other end of a pile-up.

One of the big – really big – outcomes was the cooperation and help from our own club members as well as assistance from the local VHF club. It was a great way of coordinating and consolidating club members and increasing club morale.

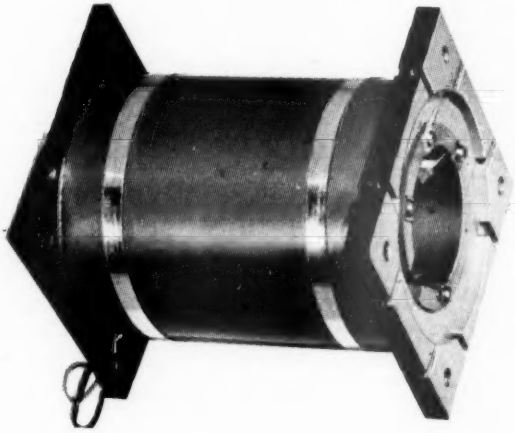
The local public relations – with help from the local news media – was also a plus to the event.

Yes, dreams do come true!

. . .Davis

DENSON

FOCUS COIL FOR 1" VIDICON



$12.95 each ppd. USA except Alaska & Hawaii. Mfg. quantity 10 for $100.00 CWO – transp. collect.

Brand new Syntronic Focus Coils (360Ω) made for Fairchild TC-175 cameras with camera schematic.

Matching Deflection Yoke only $19.95
Either Tube or Solidstate type (specify).

Free Flyers 972#3M & 972#6 now available. Loads of Bargains in CCTV Cameras, Lenses, etc.

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LETTERS

Regarding the comment by K9MGX on page 4 of the June issue, for your information, a 73 dB acoustic level certainly is not near what is normally considered the point of ear damage, (although this is loud). In addition, this figure is meaningless unless you specify whether it is rms or peak. But, either way, a symphonic orchestra is well-capable of levels in excess of that figure in an acoustically "live" auditorium at 50 feet! Are you trying to contribute knowledge or ignorance?

Clyde Wade
Little Rock AR

I'm not the type of person to write letters, but I must write and congratulate you in respect to the articles on old radio pioneers and especially the article on lightning in the June issue (written by W2FEZ).

I'm fascinated and awed when reading these articles by Mr. William Hood. These are always the first articles I read, when I open the pages of a new issue. I have re-read many of his articles several times.

Please publish more of this type of article if possible.

W. Rush W8WAT
Tucson AZ

With the increase in use of Progress Line units, I thought I would mention a few pointers on converting them for 2 meter operation. In the 4ERC25B2 receivers both coils in the antenna transformer T301 should be padded with 4 pF ceramic tubular capacitors. The whole transformer can be removed by disconnecting the coax lead and unsoldering one lead of C5, which comes out of the bottom of the can and goes to Pin 1 of the 6AK5. Remove the 2 mounting screws from the bottom of the can and lift the transformer off the main chassis. Remove the 2 sub-assemblies from the can by taking out the screws on the sides. The padding capacitors can now be placed across each of the trimmers. If any of the rf trimmers (C305, 307, or 310) on the main chassis do not tune, they can also be padded with 4 pF. In the 4ERC25D2 receiver, only the antenna transformer T336 has to be padded (using the above procedure), as everything else will tune ok. In the 30 watt transmitter the final will have to be padded with a 4 pF capacitor soldered directly across the plate trimmer C157. The 50 watt and 80 watt transmitters generally don t require any padding at all.

Jim McCullough VE3CSO

I would like to thank you for publishing the General and Advanced Class License Guides. They enabled me to pass my exam.

Also, I believe that the June, 1972 issue is the best, or one of the best, you have ever printed.

Bob McCormick WB9HFD
Champaign IL

You've finally done it. After all those articles on FM, I have no choice but to go FM. The Gods have willed it, and who am I to argue with them? "Very good," say all you FMers out there. But here's the problem. Being a student, money's a little hard to come by, and when it does, it doesn't go to ham radio. So, if somebody would like to take my Swan 270B off of my hands, I'll use the money to go FM.

I really enjoy *73* but what happened to all of the chicks on the cover?? And Wayne is so crazy that I call him the Evel Knievel of ham radio. Any takers?

Scott Liebling WA3OXG
Pittsburgh PA

I read some time ago that RCA is phasing out the 2N398A, which has been popular for quite a while as a grid-block keying transistor. It was one of a very few cheap, high voltage, PNP transistors. Some of the gang may be interested to know that the 2N5415 has come on the market recently, and at just about the same price. There are a few differences to be aware of, however. The 5415 is a silicon transistor, and its maximum safe reverse bias on the base is 4V, versus 50V for the 2N398A. Its saturation voltage is higher, 2.5V instead of 0.35V. Thus, some circuits may need a little redesign before the substitution will work. On the other hand, the 2N5415 can switch 200V, which is nearly twice as great as the 2N398A. There is an NPN which is complementary to the 2N5415; the 2N3440.

John A. Carroll K6HKB/1
Malden MA 02148

I am not a life subscriber to any magazine, but if the May '72 issue is representative of your standards, you will have my life subscription when my current one expires.

Bill Winstead WA5TND
Philadelphia MS 39350

It would be appreciated if you would announce the formation of the "Purple Martin Net" which will be on 7.251 MHz every Sunday afternoon at 4 PM CST. The purpose of the net is to bring together those amateurs who are interested in this wonderful little bird. WA5MPQ is the NCS and I (W5BW) will be the alternate. Thank you for your attention.

Thomas W Braidwood W5BW
Alternate NCS—Purple Martin Net

You've got to be kidding! Asst. Ed.

Note Asst. Editor. *QST* and *Ham Radio* did not think so. See page 57 June *QST* and page 87 June *Ham Radio* – Now who is kidding. W5BW

Well, different strokes for different folks! Keith, Managing Editor.

Thought I'd QRX from work and drop you a line to tell you how pleased I am with my subscription to *73*. I find it not only interesting, but practical. It's well worth the money (no matter how long it takes to scrape it up).

Whilst down at the Dayton Hamfest, I thought I'd try a little experiment – I subscribed to every major ham mag while I was there and then waited to see who was "on their toes." Congratulations! I received my copy of *73* first. Next in order was *CQ QST* (renewal) and last (even though I had received a postcard saying my subscription would start soon) was *Ham Radio*.

Right now I m working about 11 hours a day at my present job: which leaves almost no time for amateur radio or anything else. But rest assured that I certainly will find time for each issue of *73*.

Keep plugging on Wayne, you're doing a great job!

Charles J. Rabley WA8RUO
Greenville OH

MORE K1YSD?

I was at my friend's house reading through the June issue *73* and happened to notice the K1YSD article. I read it. Two hours later, after reducing my laughing convulsions to short bursts of snickering, my friend's parents asked me to remove myself from the premises. While walking out the door I heard them mumble something like "moron" and "bad example." Now I guess I'll have to subscribe, since whenever I go over to his house, they lock the door and won't let me in.

Joe D. Rippel WB8IMG
Chagrin Falls OH

Step on the Klutz has to be the funniest thing written in *73* Magazine since Bob, Bob, Bobbin' Along. C'mon Wayne, MORE, MORE!!

Gordon Bello WA1JWQ
Brookline MA

SALE SALE SALE

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ALSO other types of manuals

T-17 Handmike	New	$9.50
T-17 Handmike	Used	5.00
R 101/ARN-6 Receiver, 100-550 KC	100	7.00 ea.
R 23/ARC-5 Receiver, 190-550 KC	100	8.75 "
RT 66/GRC 20-27.9 MC	20	25.00 "
RT 67/GRC 27-389	20	25.00 "
RT 68/GRC 38-52-9	20	25.00 "
RT 175/PRC-9 with CY 744	5	25.00 "
RT 196/PRC-6	25	25.00 "
RT 176/PRC-10 with CY 744	12	25.00 "
RA 63A Rectifier	15	17.50 "
BC 453 Receiver, 190-550 KC	100	9.50 "
BC 458 Transmitter 5.3-7 MC	100	5.50 "
BC 604 Transmitter 20-28 KC new	100	8.50 "
BC 221 freq. meter	10	35.00 "
BC 110A swbd-C battery 50-60 cyc. 30 magneto 1 ph.	10	20.00 "
H 113 Headset new	100	2.00 "
M 95A/U microphone with boom	200	1.25 "
M 96/U microphone with boom	200	1.25 "
Canadian microphone type RS-38 with F-1 transmitter with push to talk switch	200	2.00 "
M 51/UR microphone	5000	.30 "
MC 419 lip microphone	3000	.30 "
Microphone cord with PL-68, JK 48 switch #49561 for URA	150	1.25 "
M 52 microphone	1000	2.00 "
ANBMC-1 microphone	1000	.65"
M 29A/U	500	2.00 "
OAP-Test sets radar	10	9.50 "
TS-13/AP signal generator 115 V. 1 ph 60-80	20	25.00 "
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AS 580A/ARN-30 Antenna, new, boxed	100	9.50 "
HS 33 Headset new		8.50 "
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164-201-1S	100	1.50 "
CD 807, 100 ft long	150	5.00 "
U 77/U & U78 on 30 ft cord	100	4.50 "
Cable 3E7350-1-83.3; 14 cond. #16; 8 ft long with DPDM 12A 33S-1A, DPDM 12A 34P-1A	75	2.00 "
RG 8A/U Cable, CG 399A, 100 ft long, new	100	7.50 "
H 60/PT receiver cap, new	5000	.10 "
TA-182 Converter complete	20	25.00 "
TA 182 cases	100	2.50 "
164-3 connector on 9 ft cable, new	4000	6.00 "
Heavy cable 14 cond #16; 3E7350-1-83-3 with 2 conn.		
CD 316 cord with 2 plugs, PL-55, new	700	.95 "
CX 4639 cable with 164-4 connector 164-201-1S	100	1.25 "
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CG 530 F/U Cable, 9 ft long with 2 ea: UG 260D/U con.	100	.95 "
Throat mikes T-30 new	300	.95 "
Navy Lip mikes, T-45	200	.95 "
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164-42	300	1.00 "
164-101-3S		
164-3		
UW 2020F800	1100	.75 "
164-9	700	.50 "
164-10	700	1.50 "
2 ea: 164-3 on 9 ft cord	400	6.50"
UG 254A, new	1000	.25 "
Plugs, PL-147, PL-148, PL-151A, PL-152A, PL-153A, PL-154A, PL-156A new - total 6M		for 350.00
Canadian Royal Air Force headset, 600 ohm with 2 receiver units — cord and microphone unit with push to talk switch	300	2.00 ea.
ARC-1 Transceiver, 100-156 MC-25 watt complete with all tubes	10	20.00 "
UPM-6 Test set		
UPM 11/TS-738 Range calibrator, 115V at 50-T600 cyc	10	60.00 "
UPM 18/TS-359 test set	10	40.00 "
UPM 19 Test Set complete, 2650 MC, 160 watts, 115V AC at 1.5 amp	10	60.00 "
Bendix Amplifier #3611 with tubes and motor 24V at 1.2A; 220V at 0.60A		5.50 "

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MORE LETTERS

This is in response to your letter of 22 March 1972 concerning amateur radio operations aboard U.S. Navy ships and the morale benefits afforded by such operations.

The morale benefits derived from shipboard amateur radio operations are well recognized. It is the policy of the Department of the Navy to support and encourage amateur radio activities, including those on board our ships. Shipboard amateur radio operations are generally allowed only during extended unclassified ship movements. This limitation is necessary in view of the requirements for communications security, as plain language communications to and from naval ships at sea have been determined to adversely affect our ships' operational security.

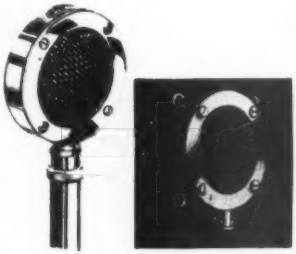
Amateur radio operations, as well as other means used for plain language communications to and from our ships at sea, have been a major concern to Fleet Commanders in Chief and to the Chief of Naval Operations from a security standpoint, particularly in times of crisis, and on a continuing basis in the western Pacific. From time to time it is necessary to curtail these operations to preclude the transmission of information over unauthorized circuits, which in the aggregate would be of value to a potential enemy. In area West of 160 degrees East Longitude have been curtailed consistently. Continued security difficulties in the Pacific area caused the Commander in Chief, U.S. Pacific Fleet, on February 1, 1969, to promulgate a directive curtailing afloat and airborne amateur radio operations, hospital ships excepted, within the Pacific Area until such time as active hostilities in that area have ceased. Since that time, the exception has been extended to include all ships on special unclassified operations such as the Apollo Prime Recovery ships.

The policies governing shipboard amateur radio operations are periodically reviewed. After a recent review, it was determined that, although the morale benefits derived from shipboard amateur radio operations are considered to be substantial, the communication security aspects are paramount. Therefore, the current policy will be continued.

In the event an article is published in your magazine, I would appreciate it if you would express my profound gratitude to the many amateur radio operators, including those affiliated with MARS, for the services they are providing our Navy people and their loved ones.

S.L. Gravely, Jr.
Rear Admiral, U.S. Navy
Director, Naval Communications
By direction of Chief of
Naval Operations

Although I hated like fury to cut up my new *73* and my 1935 Rayo catalog, I just had to draw your attention to how little the venerable 104 mike has changed in 35 years – practically none!



From Ham Buerger ad, 1970: $25

From Astatic ad, 1935: $25.20

Odd how the pictures were taken from the same perspective and that the price is virtually the same. The only difference in the 1970 model apparently is the omission of the eyelets for ring suspension.

Bob Kuehn WØHKF
St. Paul MN 55118

How about a *73* oriented brainteaser?

A group of chess playing hams planned to have a round robin chess tournament on the air. When the schedule was set up, 153 games were just too many. So they split into two equal groups and played two round robins, and the winners met in a play off. How many games did that arrangement take?

John Hunt
Pittsburgh PA 15236

ANS. A round robin takes n(n–1)/2 games.
So n(n–1)/2 = 153 given 18 men.
A 9 man round robin plays 36 games. Two of these plus the play off gives 36 + 36 + 1 = 73!

May I bring up one small point not mentioned in the aritcle "Easy Amps" in the May issue? This metering circuit monitors the current from or to the auto battery by measuring the voltage drop in the ground cable. This ground cable also is used in the starting motor circuit, and starting motors pull on the order of 200 amps when the starter has a normal load and much higher under abnormal conditions (the engine stalled in the middle of a traffic intersection on the hottest day of the year, and the air conditioner has been on all along!). One might wish to check this out before commiting a good meter. Of course, it will depend on what kind of overload the meter will take.

A similar current monitor scheme is used on many late model full size Chevrolets (especially the 1965 models) These particular models have the battery on the right, the alternator and regulator except starter motor current, is fed thru a number 12 or 10 red wire that goes across the top of the radiator frame. The factory option ammeter uses the voltage drop in this four foot wire. This method puzzled me for a while, a few years back, when I removed the idiot light cluster and replaced it with an option gauge cluster from a wrecked Impala Super Sport, and I could not find the meter shunt!

Sheldon Daitch WA4MZZ
Louisville GA

I have come up with an idea. Maybe it will or it won't work, but anyway, here it is. Since it is possible to transmit SSTV on the HF bands, why not have SSTV on FM subcarrier transmission on the VHF bands. It could be demodulated through a receiving setup similar to that of FM stereo. The main carrier could have a pilot signal or subcarrier of say 2 kHz, or possibly a subaudible frequency, or maybe a radio frequency in the VHF range, say of about 10 or 20 or 30 kHz. The only problem being that most FM signals are now being transmitted on narrowband deviation, and not wideband, in order to comply with "the-state-of-the-art" and modern receiver bandwidths. This system, of course, could be used on 1296, 220, or 450 MHz, or even 2 meters (in an unused portion of course).

Getting back to demodulation, however, the pilot signal would be the "television" video and the main "corner" the audio portion. This, of course, could be made narrowband by using a "pilot" signal or subcarrier of about 1 to 2 kHz, way below the standard deviation of 5 kHz, in use all over the country today. Is this possible? It could be, if some other hams who are interested could write to me at 50 South Porter St. Manchester, NH 03103. Any suggestions or comments would be welcome.

Michael J. Kane WA1PJG
Manchester NH

We had an odd situation here in NYC March 11th. I was on duty in the Empire State Building at altitude of 1000 ft and could see the snow coming down in a real blitz, not only nice white snow, but also big blue lightning flashes . . . on my way home I noticed that two cars with "burglar alarms" were blasting away. The guard at the exit of the building told me that they went off when "we had that big blue flash." So it seems these devices are capable of being triggered by external fields of extremely high amplitude, transient nature.

Neil W2OLU
NYC

Solid state alarm control systems can respond to transients caused by electronic fields such as lightning.

1972 SUMMER SALE

CALCULATOR CHIP – 40 DIP "Calculator on a chip" the manufacturer will not let us advertise the number of this item but we provide full data and instructions for building a 12 digit calculator ..... $14.95 ea.

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Popular numbers, all factory-marked with 2N-type numbers. Guaranteed minimum of 40 pieces of TO-5 and TO-18 mixed. Untested, but sampling indicates over 85% good.

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10 LU321 W/data $4.00

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7493 4 bit binary counter 1.15
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74193 up/down binary counter 2.00
74195 unv. 4 bit SR 1.15
8220 parity gen/checker 1.00
8200 4 bit magnitude comparator 1.60
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8281 preset binary counter 1.15
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2 to 15 ..... 2.00
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Ten (10) Teledyne TO-5 741 operational amplifiers with a two-page sheet of application notes covering the basic circuits using op-amps ..... $.65 each
Op-amp package 10-741's, data sheet and application notes ..... only $6.00

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LM100 positive voltage reg. ..... .80
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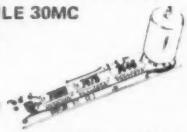
LM302 voltage follower op-amp 1.25
709 operational amplifier ..... .40
710 voltage comparator ..... .75
LM309K 5V-1A power supply module 2.50

DIGITAL COUNTER MODULE 30MC



unit includes board, SN7490, SN7475 quad latch, SN7447 7-segment driver and RCA "numitron" display tube W/decimal. 1" x 4.5" module will mount on 1" centers.

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NE567 Tone decoder, DIP (8 pin). ..... $4.25 ea.
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8223 256 bit bipolar field programmable, read-only memory $10.00
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HOT AS A FIRECRACKER That's the upcoming ARRL Hudson Division Convention, Hilton Motor Inn, Tarrytown, NY. October 21-22 are the happy days. So spend your July 4th weekend anticipating exhibits, lectures, 2 meter FM RTTY, contests, gabfests, New York sightseeing, fun. It's a blast! Write Dave Popkin, 303 Tenafly Road, Englewood NJ 07631. He'll fire off the info to you.

2 METER FM TRANSCEIVER $150. Inoue FDFM 25. Solid state, 5 watts, 6 channels (2 provided), w/Turner 350 mic. Mint condition. 213-799-6543 WB6ALS, 2023 Huntington, South Pasadena, CA 91030.

ANY REASONABLE OFFER accepted for DX100, SX100, DX40, TBS50, Globe 90, BC348, 8506B, 8503, 88LF, T18, T19, T20. Box 8352, Savannah, GA 31402.

FACSIMILE Frequency Shift Facsimile Converter CV-2A, in like new physical condition – $58; Full size AN/TXC-1 facsimile recorder (weather map type) – $99. Both together – $145. Small size "Desk-Fax" transceivers – $15, two for $25. Also, variety of fax papers. Stamp for list. Jim Cooper, W2BVE, PO Box 73-M, Paramus, NJ 07672.

SALE Drake Novice XMTR 2-NT – $95; Johnson Viking I Kw matchbox model 250-30-3 – $125; Both mint; Walt WA6FAQ, 136 Bidwell, Vallejo CA 94590.

SWAN CYGNET 260 ac/dc supply, Mic. 80 10 mobile ant. – $300. Phone: (603) 524-0716.

FOR SALE: Teletype tape printer, $5; RT-159/URC-4 walkie-talkie on 146 mc. w/batteries, $10; RT-285/URC-11 walkie-talkie, $5; MD-7 modulation xfmr, $3; AM-8/TRA-1 70–100 mc. amplifier, $8; I-122 freq. meter, $7; TRC-8 230-250 mc. antenna, $3; 3-el. 6 meter antenna w/spare elements, $4 Plus postage. WB4GEW, 3344 High Hope Rd., Lexington KY 40502.

NATIONAL AMATEUR CRYSTAL BANK A central receiving, testing and matching service for exchanging 2 meter FM crystals. Send SASE for details. National Amateur Crystal Bank, Dept. 73, PO Box 1, Wykagyl Station, New Rochelle, NY 10804.

WANTED COLLINS Mechanical Filter 455-FC-60 or equiv. 6 kHz BW for Hammurlund HQ215 Rcvr. W1FOT/KV4 Box 3374, St. Thomas USVI 00801.

FOR SALE Hallicrafters SR42a and HA26 with four crystals, mike, antenna and handbooks. Complete two meter station. Mint condition in original cartons. Will pack to ship freight collect. $155 certified check or money order. K6UQC, 6028 Ellenview, Woodland Hills CA 91364. (213) 888-1522.

CINCY STAG HAMFEST: The 35th Annual STAG Hamfest will be held on Sunday, September 24, 1972 at the ALL NEW Stricker's Grove, on State Route 128, one mile west of Ross (Venice) Ohio. Check local area map for new location. Door prizes each hour, raffle, lots of food, flea market, model aircraft flying, and contests. Identify Mr Hamfest and win prize. $5.00 cost covers everything. For further info. contact: John Bruning W8DSR, 6307 Fairhurst Avenue, Cincinnati, OH 45213.

VHF NOISE BLANKER Models available for VHF transceiver and receiver-converter systems. See advertisement in July issue 73. WESTCOM ENGINEERING, Box 1020, Escondido, CA 92025.

YOUR CALL LETTERS Two sets, for windshield and rear glass. Smart white letters with red outline. Easily installed pressure sensitive decals. $1.00, postage paid, anywhere. Satisfaction guaranteed. Lake Jordan Artists, Slapout AL 36092.

NO QRN Wyoming ranch land. Wild Horses, Antelope, Deer. 10 level acres $20 down, $20 month. Mike Gauthier, K6ICS, 9418 E. Florence, Downey CA 90240.

HAMFESTERS 38th Hamfest and Picnic, Sunday, August 13, 1972, Santa Fe Park, 91st and Wolf Road, Willow Springs, Illinois, Southwest of Chicago. Exhibits for OM's and XYL's. Famous Swappers Row. Information and Tickets, Joseph W. Poradyla, WA9IWU, 5701 S. California Ave. Chicago, IL 60629.

FM IC-20 & REGENCY-2A owners, Now Available, 4 frequency tone burst oscillator, internally mounted. $29.50. Bob Brunkow 15112 S.E. 44th Bellevue, WA 98006. Phone 206-747-8421.

FIGHT TVI with the R.S.O. Low Pass Filter. See p115, March 1972, 73. Write for brochure. Taylor Communications Manufacturing Co., Box 126, Agincourt, Ontario, Canada.

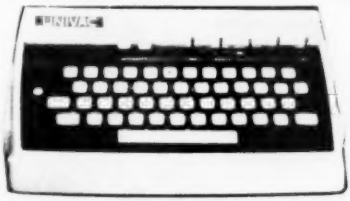
FOUNDATION for Amateur Radio Annual Hamfest, Sunday 22 October 1972 at Gaithersburg, Maryland Fairgrounds.

...AND MORE!

I always thought in your magazine and Repeater Bulletin, the "Letters" section was devoted to letters to you, but I find in Bulletin No. 5 a copy of a letter to *me* from Dick Morris, K1WZR complimenting our service. Thank you very much for including it ... it was really a surprise, although I noted on Dick's letter that he did send you a copy. To me, after putting in 10 and 12 hours daily, then several sleepless nights weekly due to ideas "buzzing around in my head" about how we might improve our service to customers and build our business – after all that, the sweetest sound in the world is a letter of appreciation like this one.

We're building our business on service, Wayne, and I feel much like a friend who was recently trying to "dream up" a spare-time business: He said "I know there are many people out there who are willing and anxious to spend money on some service I can provide – all I have to do is find out what it is." In our case, our decision is what we can offer the amateur that will make him decide to deal with us rather than our competitors, and the best answer we've found is service. We've been told as we grow, our ability to offer such fast personal service will decrease. I hope not, and am formulating plans to insure that it won't. As of now, however, we *can and do* provide it, and letters like Dick's are an excellent way to get this message over to the amateurs, and we do deeply appreciate your help in this rather unusual way!

Ed Juge W5TOO/W5NGL
Fort Worth TX 76110



COMPUTER KEYBOARD W/ENCODER $35

Another shipment just received. Alpha-numerics keyboard excellent condition. Once again we expect an early sellout. Price of $35 includes prepaid shipment in the US and shipment made within 24 hours of receipt of order.

COMPUTER KEYSWITCHES

Another fantastic bargain for the builder. We have brand new bounce-less micro switch keys, spares from the above units, less key-tops. Make up your own keyboards. Made for PC mount. Package of 48 brand new key-switches only $12.00 postpaid.

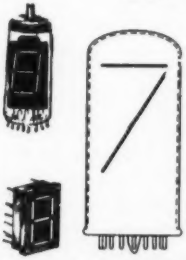
TS 323 FREQ. METER

Similar to the familiar BC 221 except this one covers range of 20—450 mc. Accuracy .005% Used, guaranteed OK, less batteries, with schematic. TS-323 ship sgt 35 lbs. $50.00

POWER TUNEABLE VARACTOR $5.00

Similar to MA-4060, used in doublers, triplers, amplifiers, etc. Fully guaranteed, with specs and some circuits. $5 each or 6 for $25 pp.

DIGITAL READOUTS



GE Y 4075 25V Miniature $1.75

GE Y 1938 24V Standard $1.75

RAY CK 1905 Standard $1.75

MAN-3 1.7V Miniature $3.50 ea. 10/$30

GIANT ALPHA NUMERIC B7971 $1.75

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Complete brand new memory core stack w/diode matrix, 65, 536 core. Appear to be brand new. $100

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Brand new Laser Storage high speed discharge caps. 40μF at 3KV. each $10

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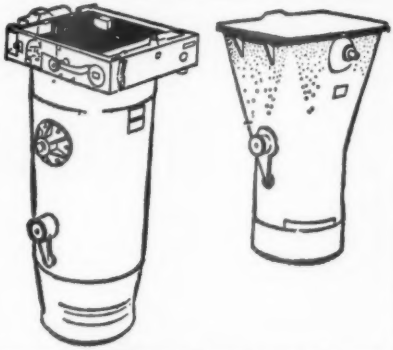

6″ f/6.3 METROGON wide-angle lens (73° angle of view). In cone with shutter; fabric shipping trunk included. **$15.00.** Filters, red or yellow, **$3.00 each.**

6″ f/6.3 METROGON wide-angle lens (73° angle of view). In cone with electric Rapidyne shutter. **$25.00.** Filters, red or yellow, **$3.00 each.** Fiberglass shipping trunk, 21″ by 18″ by 13″, **$20.00.**

24″ f/5 lens assembly in K-17 cone with shutter and iris. **$30.00 each.** Filters, red or yellow, **$5.00 each.** With electric Rapidyne shutter, **$40.00.** Fiberglass trunk, 26″ by 30″, **$25.00.**

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In designing these circuits, the following three points were kept in mind: One, reliability; two, simplicity; and three, low cost.

The home burglar alarm uses magnetic reed switches (normally open). They are composed of two halves. One half is a magnet, the other half is a switch. One complete unit is required for each door and window. The magnet half is embedded in the top of the door or window, the switch half is embedded in the top of the door or window jamb, with connecting wires.

The embedding is done with a router. The relay is a single-pole contact with a 12V coil. The contact rating is determined by the amount of current necessary to activate the alarm (horn or bell). As will be noted from the diagrams, no current flows until one of the switches is activated. When this takes place, the relay closes, thus completing its own electrical path, so even if doors or windows are closed after opening, the alarm will keep going. The only way it can be stopped is by either the key switch or the battery running down. Naturally, a time relay may be used to shut off the circuit after a predetermined time. However, I prefer continuous operation. Battery life is normal shelf life unless the system is activated.

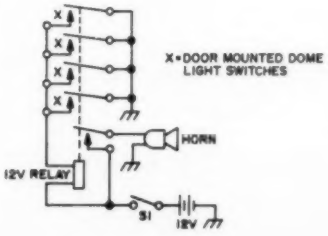

Fig. 1. Auto alarm.

The automobile alarm uses the existing dome light switches which are embedded in the door jambs, and in no way alters dome light function. Also, the alarm horn is the existing horn. The key switch to activate or deactivate the system is placed in some inconspicuous place on the body of the car. If the hood is to be protected, use a magnetic reed switch or a mechanical switch, so that when the hood is closed, the switch is open. The wire from the battery to the relay contacts and from the contacts to the horn should be at least #10 wire.

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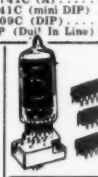

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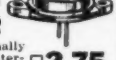

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I have a little bad news for some Technicians who use repeaters. Several citations have been issued to users of the Los Angeles WB6ZDI machine which uses 146.610 as the input and 147.330 as the output. Both Richard Burton, WB6JAC, and Carl Siminow, WA6JOW were cited for "OPERATING ON A FREQUENCY NOT AUTHORIZED FOR TECHNICIAN CLASS LICENSE. NON-COMPLIANCE WITH SECTION 97.7 (c) OF THE FCC RULES AND REGULATIONS." I was under the impression that a Technician could legally be transmitted out of his segment if the licensee of the repeater had a General Class license or higher. Not so says the FCC. I had a very interesting telephone conversation with Mr. Jack W. Bazhaw, K6FLO who is the Engineer in-Charge of the Santa Ana, California FCC Monitoring Post. Mr. Bazhaw, himself a repeater user. (W6FNO) explained that the FCC considers it illegal for a Technician Class licensee to be retransmitted out of his frequency authorization. The important point to note here is that the FCC puts the burden of responsibility on the Technician and not the repeater owner or licensee. I know of several repeaters around the country with an output above 147 MHz. I know there are many Technicians innocently using these machines and not aware of the Commission's decision. Hopefully, Docket 18803 will solve this and other problems. However, until 18803 is acted on, remember, it is illegal for a Technician to use a repeater with an output above 147 MHz. I realize some of you are asking, "What if the Technician does not realize he is being retransmitted out of the band?" I know there are a few areas of the country where, because of several repeaters using common inputs, you can transmit and never know on how many frequencies you are being repeated. I am afraid that there is just no way you can be sure, especially if you have a good installation for a base station and operate during the frequent band openings on two meters.

While we are awaiting the outcome of Docket 18803, the Europeans have made their decisions and rule making for repeaters. Their new rules and regs parallel those of the United States, in many ways. I am told the delegation used areas of our country where the repeater operation is organized for their guide. They used southern California to show how not to do it. I greatly admire the southern California group. They were, for the most part, responsible for the rapid growth and acceptance of FM and repeaters. However, times are changing. The entire country, with the exception of the southern California area has organized and standardized. Without ruffling any feathers, I do urge the repeater owners and operators in that area to follow the trend of the country and now Europe.

Back to the FCC, on another subject, the Commission has authorized U.S. amateurs to communicate with XV5AC near Saigon. So, another restricted country is back on the OK list.

I was invited down to Philadelphia on June 17 for the first annual Kassvention, along with such people as Bob Cushman of Cushcraft, Sam Rainwater for Henry, Doug Horner from Drake, and many others. Everyone had a great time. Kass has, in my opinion, one of the finest facilities around. Just about anything needed from complete stations to those hard to get parts can be found at Kass. Thanks to Vince and Al of Kass and

(continued on page 136)

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Only Yaesu offers this type of remote, one-handed control of the scanning function.

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4

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